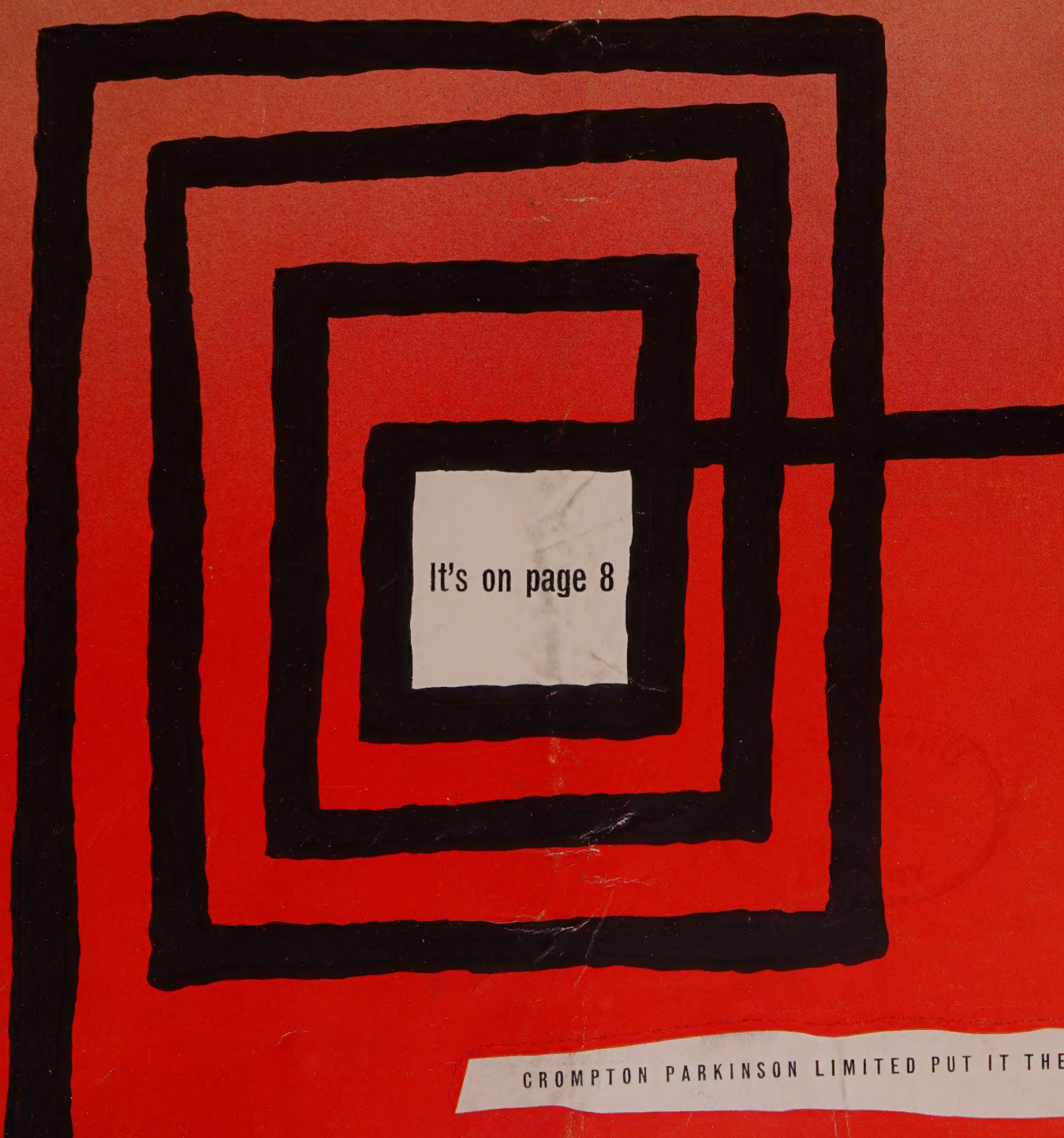


4 ELECTRICAL REVIEW

FRIDAY
JANUARY 1960

WEEKLY
PRICE 1s 6d

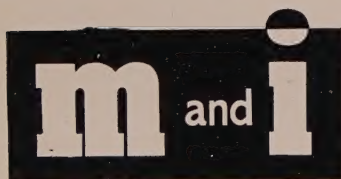
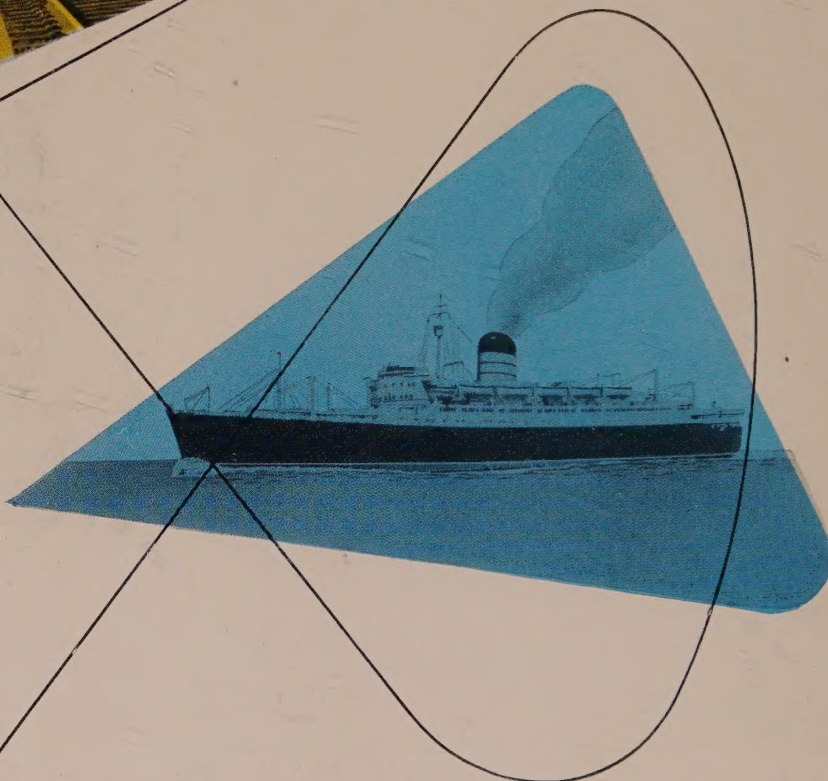


It's on page 8

CROMPTON PARKINSON LIMITED PUT IT THERE



On land, at sea
and in the air
M & I products
are everywhere



the
electrical
insulation
people



Photographs by courtesy of
British Railways, The Cunard Steam-Ship Co. Ltd.,
and Vickers-Armstrongs (Aircraft) Ltd.

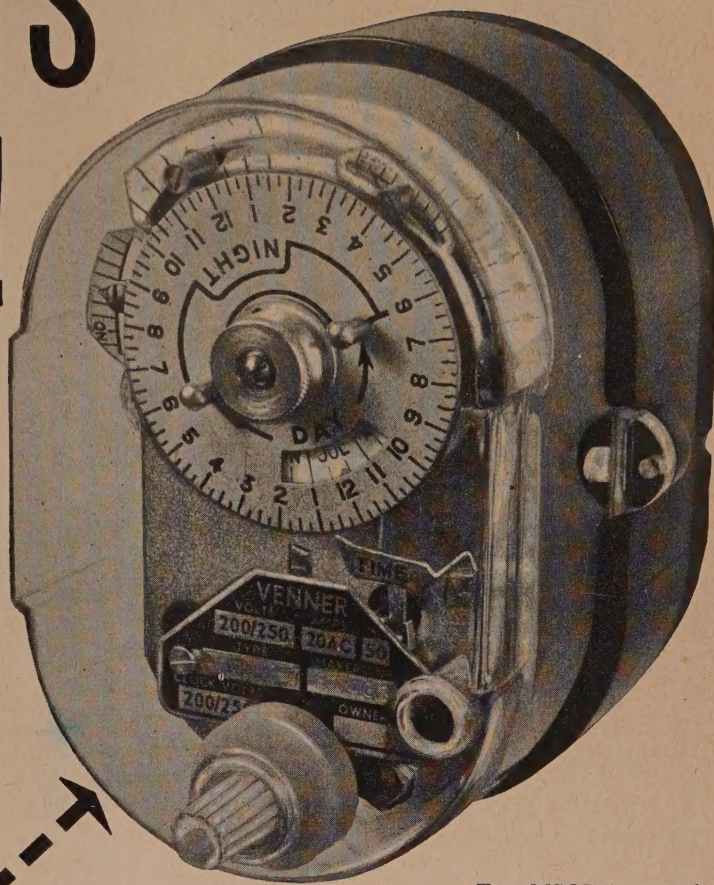
THE MICANITE & INSULATORS CO. LTD., WALTHAMSTOW, LONDON, E.17.

Telephone: Larkswood 5500

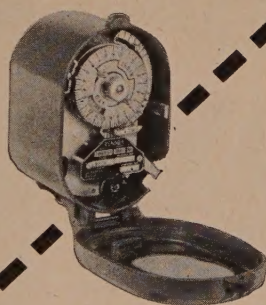
Telegrams: Mytilite, London, Telex

Telex 25183

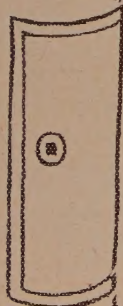
STREETS AHEAD!



Type MSQP time switch in C151 die cast aluminium box.



Type MSQP time switch in C173 plastic box with transparent cover.



For efficiency and economy in street lighting there is nothing to touch the Venner Type MSQP Time Switch. It has a large dial for easy setting, small overall dimensions to fit into modern street columns and can be supplied with a clear plastic clip-on cover or in a metal die-cast box with top clip fastening.

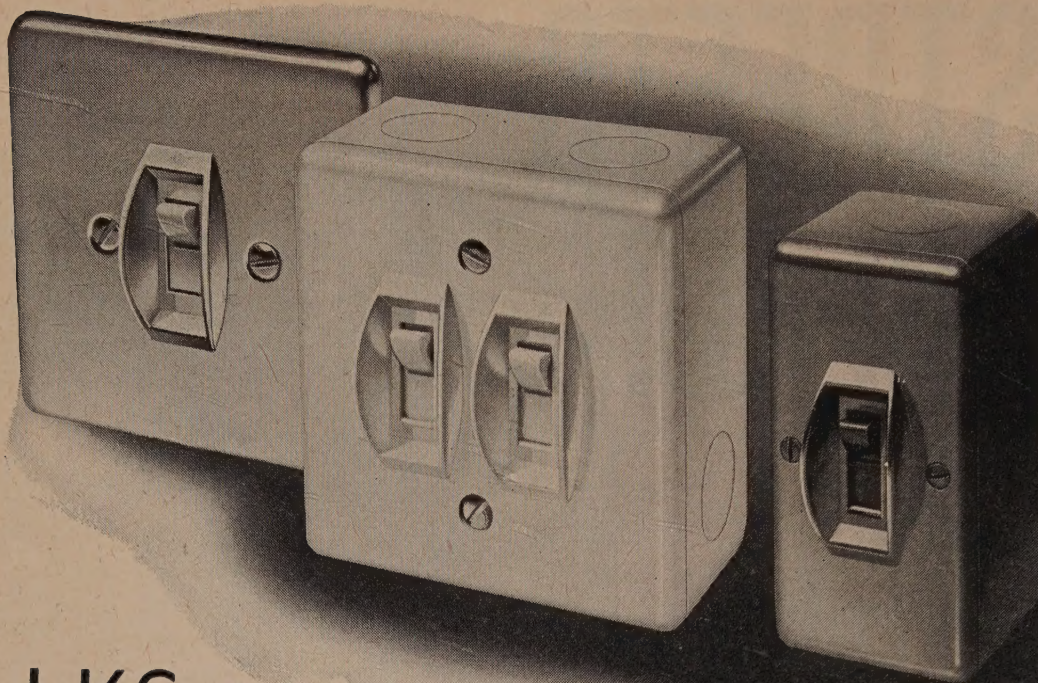
You are invited to send for full details of Venner Solar Dial Time Switches, write for leaflet E.R./16.

VENNER

Time Switches

VENNER LIMITED, Kingston By-Pass, New Malden, Surrey

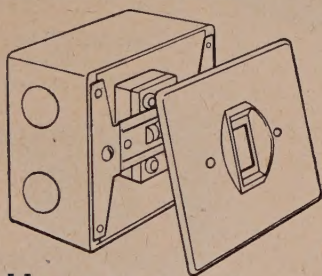
• Telephone: MALden 2442



FALKS

new **METALCAST** switches
for use in offices, hospitals, schools, etc.

Special features include:

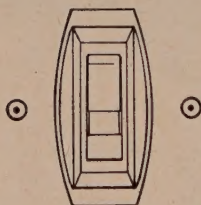
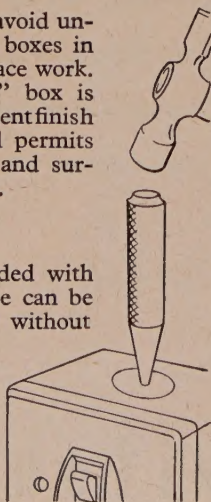


Matching covers and boxes

It is possible to avoid unsightly cast iron boxes in commercial surface work. The "Metalcast" box is of the same excellent finish as the plate and permits matching flush and surface installations.

Knockouts

Boxes are provided with knockouts. These can be removed cleanly without spoiling the finish. They thus obviate difficult drilling or bench work on site.

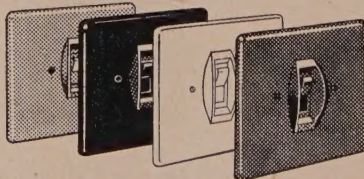


Effective dolly protection

The dolly cannot be damaged owing to the raised side protectors which also add distinction to the design.

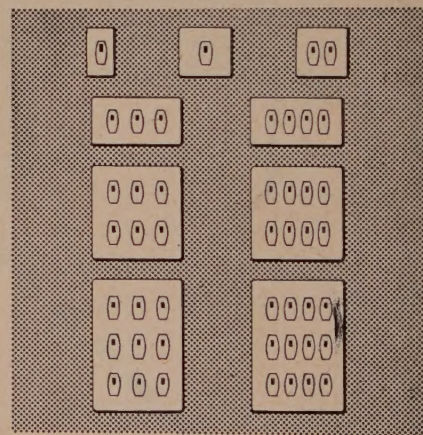
Secret fixing

Where required for schools and institutions all models can be supplied with plate fixing by miniature Allen screws.



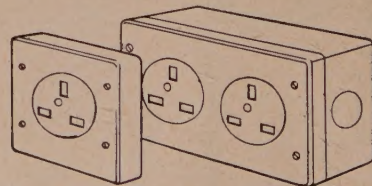
Choice of finishes

The complete Metalcast range is available in Florentine Bronze Plated Finish, Bronze Enamel, Silvercote Enamel or White Enamel. The enamels are based on an epikote resin to give great surface hardness and a resistance to acids and alkalis.



Widest range of all

See diagram—This applies to both flush and surface fixings.



Matching 13 amp sockets

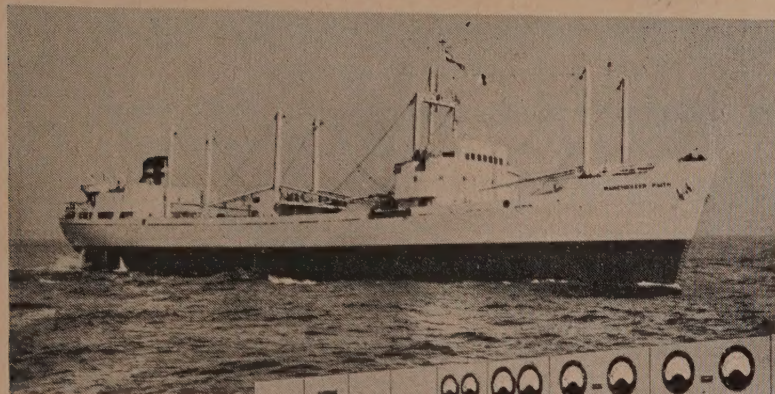
In finishes as above, single and double units, unswitched, the single unit also being available switched.

FALK STADELMANN & CO. LTD., 91 Farringdon Road, London, E.C.1.
HOL 7654. Showrooms at: 20/22 Mount Street, London, W.1. MAY 5671

Branches at: Glasgow: Central 9494 (4 lines). Edinburgh: CAL 2364. Manchester: Deansgate 3351. Liverpool: Central 7683/4/5. Birmingham: Central 8031/2/3. Newcastle-under-Lyme: Tel. No. 69573. Dublin: Tel. No. 77694/5. Cardiff: Tel. No. 30351. Swansea: Tel. No. 55442. Newcastle-on-Tyne: 22483/4/5. Leeds: Tel. No. 29741/2. Bradford: Tel. No. 21905. Nottingham: Tel. No. 51448/9. Brighton: Tel. No. 64077/8. Southampton: Tel. No. 21336. Bristol: Tel. No. 27117/8. Belfast: Tel. No. 31269.

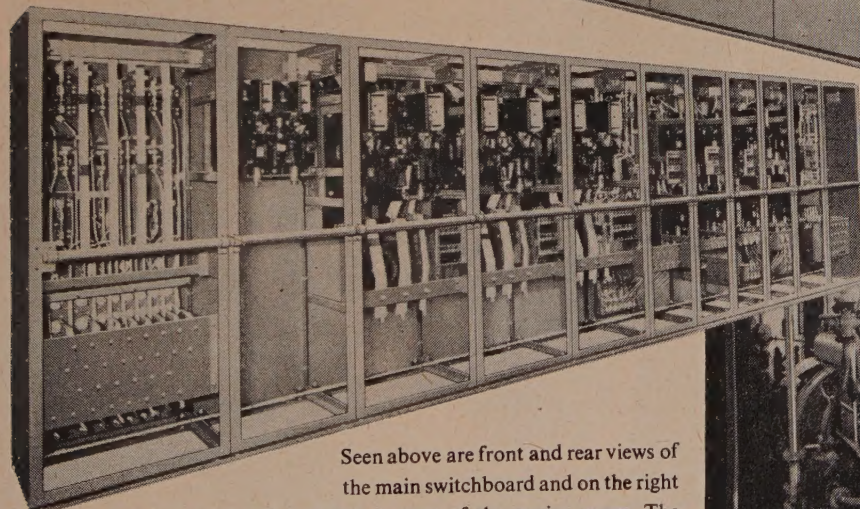
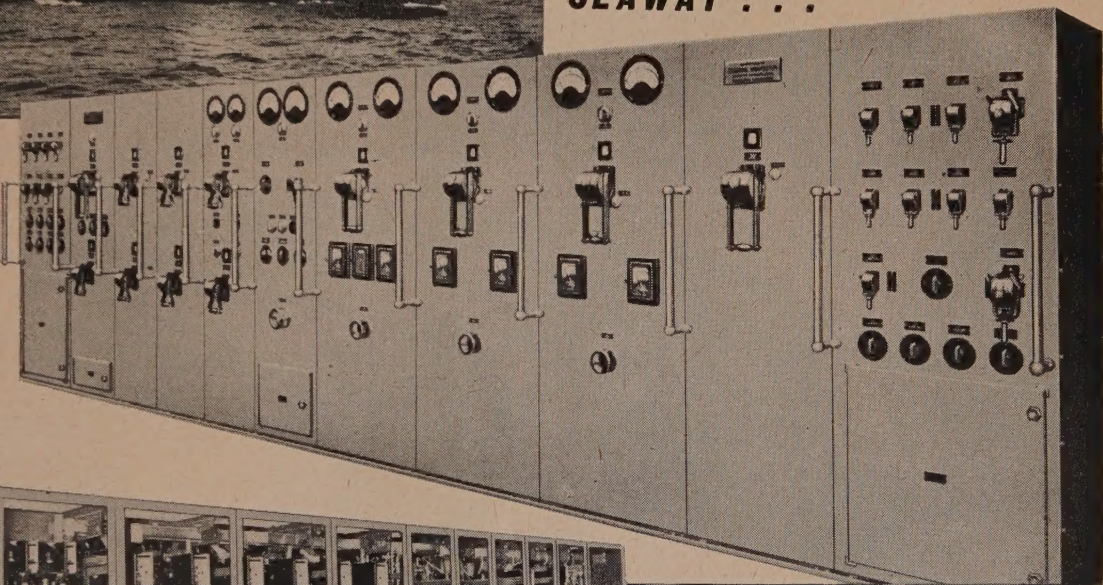
FALKS

Leading the way... 'ERSKINE HEAP' Switchgear

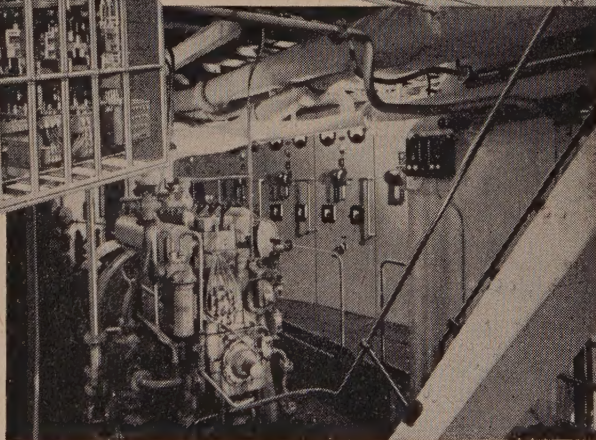


INSTALLED IN THE
'MANCHESTER FAITH'
THE FIRST BRITISH SHIP TO
ENTER THE ST. LAWRENCE
SEAWAY . . .

This modern cargo ship, together with her sister ship, "Manchester Fame", both of which have Erskine Heap main switchboards, were built for Manchester Liners Ltd. by Austin & Pickersgill Ltd., Electrical Contractors, Sunderland Forge & Engineering Co. Ltd.



Seen above are front and rear views of the main switchboard and on the right a view of the switchboard installed in part of the engine room. The Switchboard is of the dead front pattern with back-of-board circuit breakers and knife switches operated from the front.



WE MANUFACTURE :- L.T. SWITCHGEAR 50/7,000 Amperes. E.H.T. SWITCHGEAR up to 11 kV. 250 MVA rupturing capacity. MOTOR CONTROL GEAR 1/4/5000 H.P.

ERSKINE, HEAP & CO LTD

SWITCHGEAR SPECIALISTS

Head Office & Works
BROUGHTON, MANCHESTER (7)

London Office
GRAND BUILDINGS, TRAFALGAR SQ., W.C.2

BRANCH OFFICES AND AGENCIES IN ALL PARTS OF THE WORLD

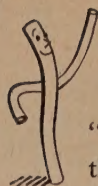


May we have your enquiries?

WELCOME TO OUR STAND No. A.9, ELECTRICAL ENGINEERS' EXHIBITION, EARLS COURT, LONDON, APRIL 5th — 9th

*"Ever
thought of
coal-crushing
as a career?"*

they asked us.



"Er . . . no" we confessed—not realising that anyone crushed coal on purpose.

"A job of National Importance" they tempted us.

"O.K., we'll take it," we agreed.

"Don't run away with fancy ideas," they warned, "your job will be insulating the electric motors that operate the plant."

"A pushover," we replied recklessly.

"If you don't mind working entirely without ventilation" they said "totally enclosed by welded-in sheet steel covers. Gets kind of hot"—they added nastily.

"Just our cup of tea," we gulped—and took the job.

Years later—meaning now—we are still at it.

Is it hot? Compared to this situation, the equator is a cold bath. Do we break down? Never!

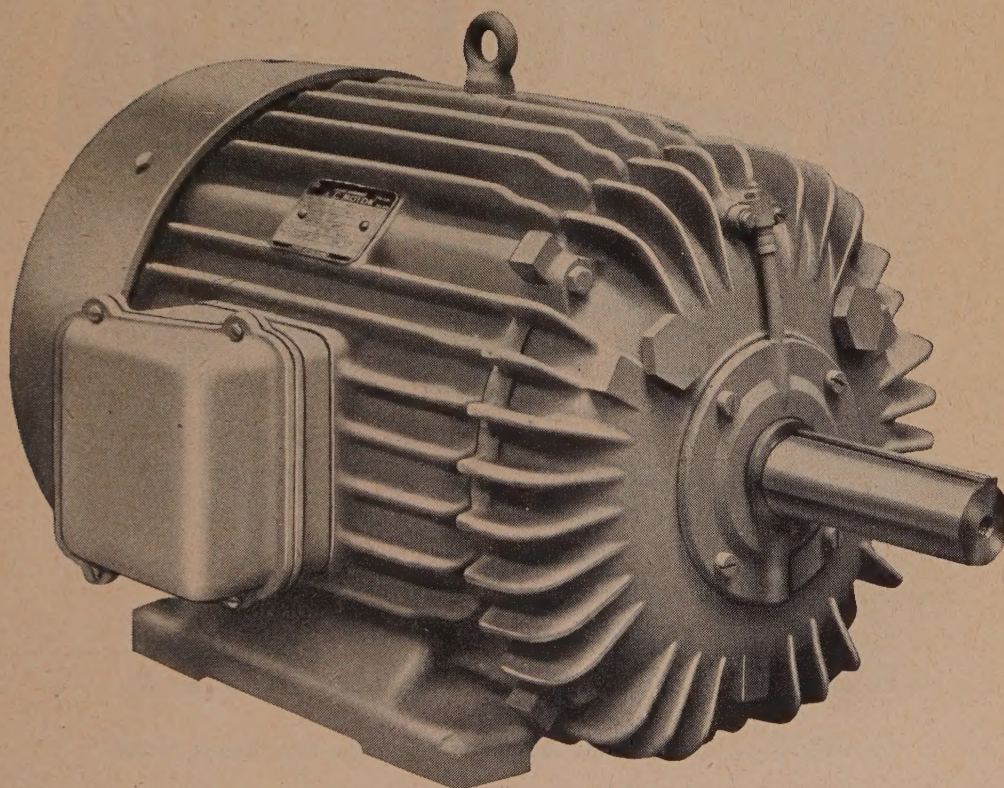
Fibreglass electrical insulation can take anything!



If it's tough, it's just the job for

FIBREGLASS TRADE MARK **ELECTRICAL INSULATION**

**AEI announce
a new range of totally-enclosed
fan-cooled motors
TYPE KN-D**



INTERCHANGEABLE WITH
BRITISH STANDARD-DIMENSION DRIP-PROOF MACHINES

- * Class E insulation
- * Compact construction

- * High power/weight ratio

AVAILABLE NOW UP TO $7\frac{1}{2}$ h.p.

Please write for further details

AEI

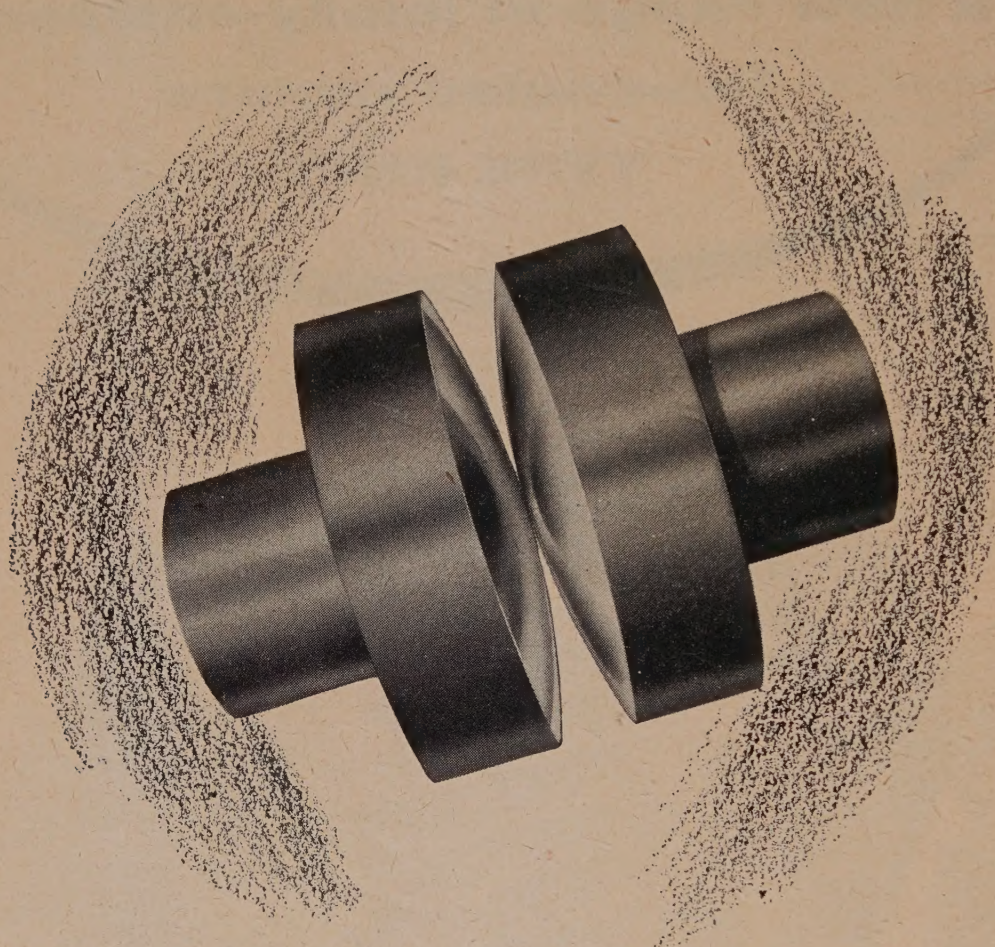
Associated Electrical Industries Limited
Motor and Control Gear Division
RUGBY, BIRMINGHAM AND MANCHESTER, ENGLAND



INCORPORATING THE MOTOR AND CONTROL GEAR INTERESTS OF BTH AND M-V



tête-à-tête



Put two heads together (of the same shape) and the result is a cheaper job . .

In the majority of medium duty contact applications, two domed rivets will perform as well as the domed/flat combination often employed. The adoption of one type of rivet instead of two means that your ordering quantities go up and our price goes down. Nor is that the only saving—for your storage and handling problems are also simplified.

Specialised Products of

Johnson  **Matthey**

Domed rivets are only a small part of the JMC range of electrical contacts. We have immense experience of contact problems—let's put our heads together to help you with yours.

JOHNSON, MATTHEY & CO., LIMITED, 73-83 HATTON GARDEN, LONDON, E.C.1

Telephone: Holborn 6989

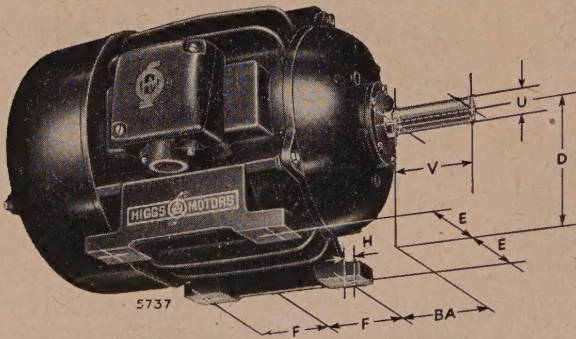
Vittoria Street, Birmingham, 1. Telephone: Central 8004

75-79 Eyre Street, Sheffield, 1. Telephone: 29212

NOW

T.E.F.C. TYPE "D" MOTORS

DIMENSIONS AS B.S. 2960
CLASS 'E' INSULATED 65°C TEMP. RISE

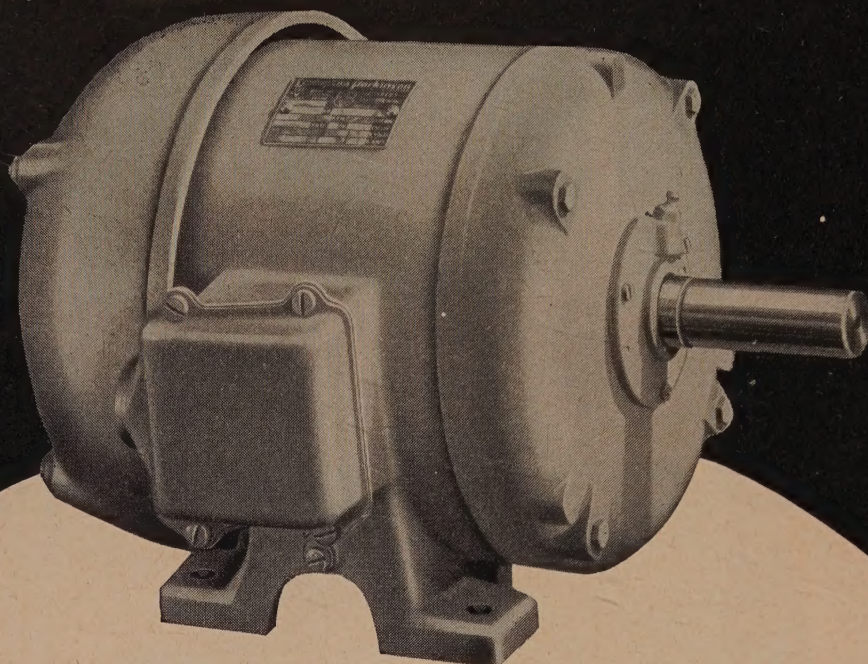


AVAILABILITY

NOW

SHORTLY

Ratings h.p.				Frame Size	D	E	F	BA	H	U	V	Key	
3000	1500	1000	750									Width	Thick-ness
1 1/2	1 1/2	1 1/2	1 1/2	D162	4	3	2	2 1/2	3/16	3/16	2 1/2	3/16	3/16
2	2	2	2	D164	4	3	2	2 1/2	3/16	3/16	2 1/2	3/16	3/16
3	3	3	3	D182	4 1/2	3 1/2	2 1/2	2 1/2	7/16	3/16	3	5/16	3/16
5	5	5	5	D184	4 1/2	3 1/2	2 1/2	2 1/2	7/16	3/16	3	5/16	3/16
7 1/2	7 1/2	7 1/2	7 1/2	D213	5	4 1/2	3 1/2	3 1/2	7/16	3/16	3 1/2	5/16	3/16
10	10	10	10	D215	5	4 1/2	3 1/2	3 1/2	7/16	3/16	3 1/2	5/16	3/16
15	15	15	15	D254	6 1/2	5	4 1/2	4 1/2	9/16	3/16	4 1/2	7/16	5/16
20	20	20	20	D256	6 1/2	5	4 1/2	4 1/2	9/16	3/16	4 1/2	7/16	5/16
25	25	25	25	D284	7	5 1/2	4 1/2	4 1/2	9/16	3/16	5 1/2	5/16	5/16
30	30	30	30	D286	7	5 1/2	4 1/2	4 1/2	9/16	3/16	5 1/2	5/16	5/16
	40	40	40	D324	8	6 1/2	5 1/2	5 1/2	1 1/16	2 1/2	6 1/2	7/16	7/16
				D326	8	6 1/2	5 1/2	5 1/2	1 1/16	2 1/2	6 1/2	7/16	7/16



A new range of totally-enclosed fan-cooled motors...

Smaller, lighter than previous T.E.F.C. standards...

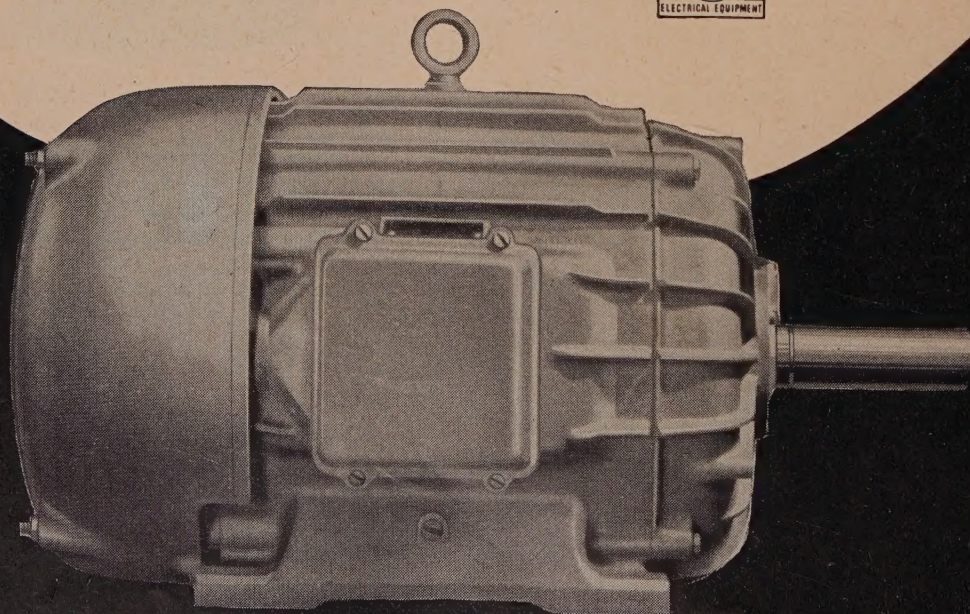
Frame sizes identical with ventilated motors of the same rating... the T.E.F.C. range of Series 5 A.C. motors made by

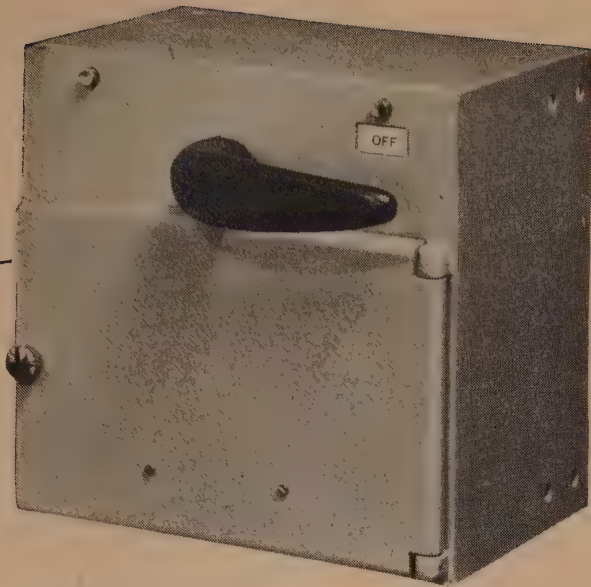
Electrically these motors conform to B.S. 2613:1957 Class E insulation. Dimensions conform to a new B.S. draft specification and are the same as Series 5 ventilated motors which can be found in B.S. 2960:1958. These motors can be supplied interchangeable with N.E.M.A. totally-enclosed, fan-cooled motors of the same rating.

The first batch—ratings from 1 to $7\frac{1}{2}$ h.p. at 1400 r.p.m. can be ordered now. The remainder of the range, 10 h.p. to 40 h.p. at 1400 r.p.m., will be available during the Spring.

Write for full technical information

Crompton Parkinson
LIMITED





**Take one box
nine inches square...**



This front handle operated, isolator or fused switch typifies the Variletric range of switchboard components—*adaptable and compact*. Fuseboards, busbar-chambers, tap-off systems, etc., all have been designed with the same underlying principle: used together they form a compact switchboard 'tailor-made' to any location regardless of shape or size. Removable case and removable doors for ease of wiring are another feature. Please write for further information of Variletric Cubicle Pattern Switchboards to:-

VARILETRIC
LIMITED

MELON ROAD, LONDON, S.E.15.

Telephone : Rodney 6895/6/7

13,600 feet

of new **KEY** triple unit fibre

UNDERFLOOR DUCT



for the new **Daily Mirror** building



SOLVES ALL PRESENT AND FUTURE ELECTRICAL DISTRIBUTION PROBLEMS

Now and for the future, this immense Key Underfloor Duct installation will solve electrical distribution problems in the 'Daily Mirror' building. The system provides unique flexibility because once the duct is laid, outlets for power and telephones can be added anywhere to suit individual needs. These outlets can later be increased and extended as needs in the building change, without disturbing floors or existing wiring.

LOW COST — EASY TO INSTALL

Here closed-bottomed 'dee'-shaped duct is used, but an open-based duct is also available. Both can be economically and speedily installed. The ducts are light in weight, and easy to cut and work with normal wood-working tools. They are cheaper than any other system.

For new or existing buildings

NEW SKIRTING DUCT can be used where the installation of underfloor ducting alone would be impracticable, extending still further its convenience and flexibility.

NEW DADO DUCT is similar to skirting duct and is designed for use at desk height. These two systems and underfloor ducting itself can be used alone or in conjunction with one another in both new and existing buildings.



First and foremost in Underfloor Duct Systems



'PHONE OR WRITE TO:

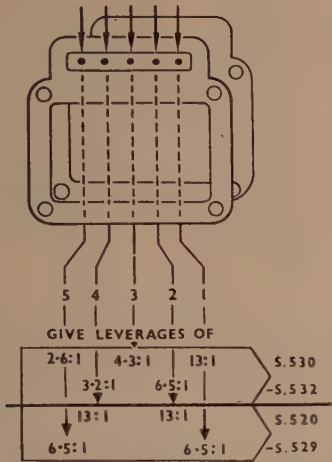
THE KEY ENGINEERING COMPANY LTD

BLACKFRIARS HOUSE, NEW BRIDGE STREET, E.C.4 TELEPHONE: FLEET STREET 4150

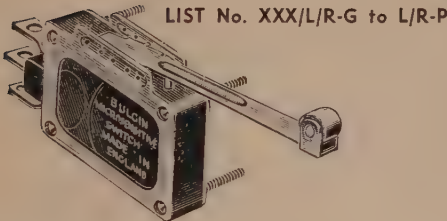
TGA UD5R

OPERATING LEVERAGES

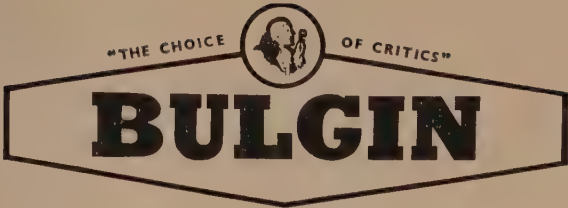
Diagram illustrating alternative pivot positions and operating leverages available.



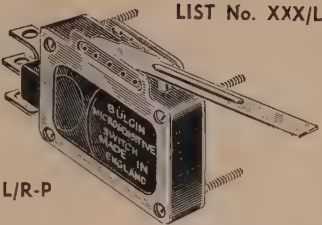
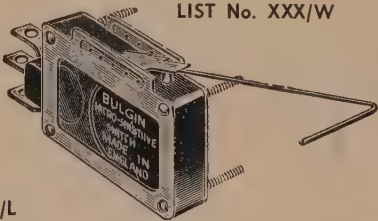
BRITISH PATENT
738422
U.S.A. PATENT
2828372



The operators, freely pivoted, add no forces to the switches, except their own weight. Leverages from $2\frac{1}{2} : 1$ to $13 : 1$ are given—see diagram top left. Operation-pressures are divided and operation-distances are multiplied, by the leverage obtained. For the past 10 years we at the House of Bulgin have devoted many pains-taking hours to design and research in Micro Switch manufacture. Today we have a comprehensive range, fully tried, tested and accepted by the Electronic Industry throughout the world, constantly this range is augmented with new versions presenting wide selections of standard, miniature, open, lilliputian and ganged varieties, ideally suitable for a high percentage of duties in most types of equipment. For full range and technical details request leaflet Code No. M.S.L.5.



TO increase the utility of the large range of "M" Micro Switches (full technical details page 97 Bulgin Catalogue) we offer six different Operator Attachments. Each operator being complete with a pair of side brackets, and four 8-B.A. bolts and nuts, for the sandwiching assembly and fixing. Each operator-lever can be pivoted in its brackets, in up to 5 different ways; providing over 750 possible combinations! Side brackets are of brass and barrelled-nickel-plated; Operators-levers, are nickel silver blades. The rollers and wire extensions are as tabled. Patented by BULGIN in the U.K. and U.S.A. All the devices on this page are essential when operating movement is by wiping or smearing motion—as with Cams or Slides, and not by direct button movement. **Note:** Wipe, or slide-deflexion to be away from Lever-anchorage or pivoting.



THE ONLY MICRO SWITCH
MANUFACTURED OFFERING
SIMPLE ADJUSTMENT OF
OPERATING LEVERAGE

EXTERNAL OPERATORS

Add suffix to List No. of Switches	TO OBTAIN EXTERNAL OPERATOR	
Stainless Steel Wire -/W		
Nickel-silver blade -/L		
-/L/R.G.* -/L/R.B.* -/L/R.SS.* -/L/R.P.*		

*Having GRAPHITE, NICKEL-PLATED, BRASS, STAINLESS STEEL and TUFNOL (PLASTIC) ROLLERS, respectively. Note: Operators may also be reversed to project towards terminal tags.

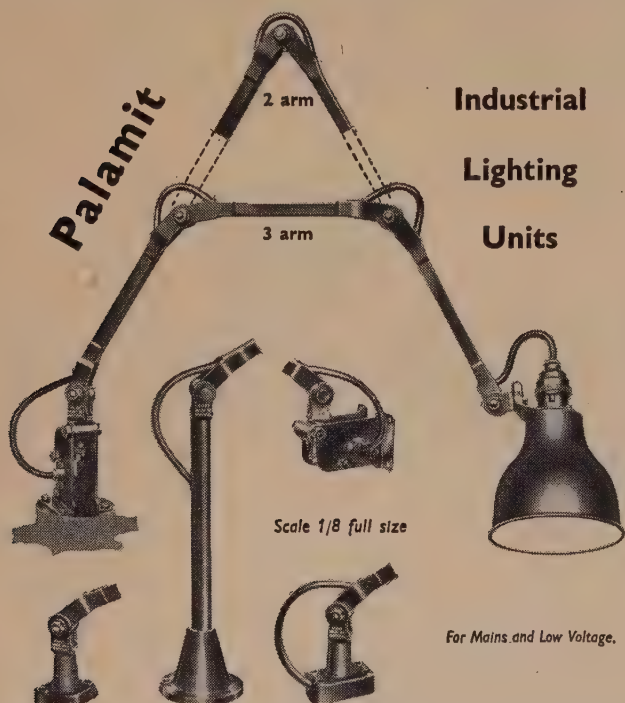
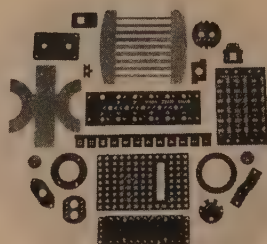
A. F. BULGIN & CO. LTD., BYE-PASS ROAD, BARKING, ESSEX
TELEPHONE: RIPPleway 5588 (12 lines)

ENALON PLASTICS LIMITED

Phone: TONBRIDGE 3343/4/5 **DRAYTON ROAD · TONBRIDGE · KENT** Grams: 'ENALSCO'

Specialist Manufacturers of Plastic Materials to the
Electrical, Radio and Television Industries . . .

- ENALON** PRECISION WOUND COIL FORMERS
- ENALON** MACHINED INSULATION COMPONENTS
- ENALON** S.R.B.P. TUBING
- ENALON** STAMPINGS and COMPONENTS



Palamit units are for use where the advantages of **MEKELITE** units have to be sacrificed to the consideration of low first cost. The difference in price is due to the simplified design and not to lower standards of material and workmanship.

Various arm lengths (max. horizontal reach 39 in.). Five sizes of reflector. Seven types of base. Full particulars on request.

MEK-ELEK Eng. Ltd., Western Rd, Mitcham, Surrey
Phone: MITcham 3072 Cables: MEKelek, London



That nut must *stay* tight.
That pin securely locked.
Either way, the job calls for
GROVERLOK.

GROVERLOK spring lock-washers, in girder, flat or square section ensure that any nut will remain tightly fixed.

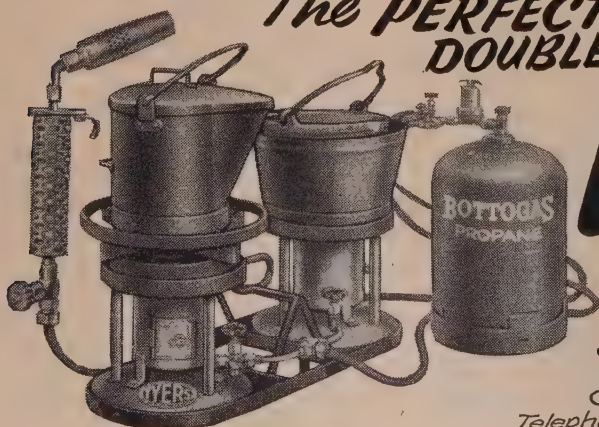
GROVERLOK spring tension pins fit accurately, tightly, without special drilling or reamering.

Both can easily be used by unskilled labour, both are thoroughly reliable.

GROVER & CO. LTD.

BRITANNIA ENGINEERING WORKS
CARPENTERS RD., LONDON, E.15
TELEPHONE: MARYLAND 4342-3

The PERFECT DOUBLE



We recommend
SHELL MEX & B.P. GASES LTD. PROPANE

For details, apply: **SHELL MEX & B.P. GASES LTD.**
Cecil Chambers, 76-86 Strand
LONDON WC2.

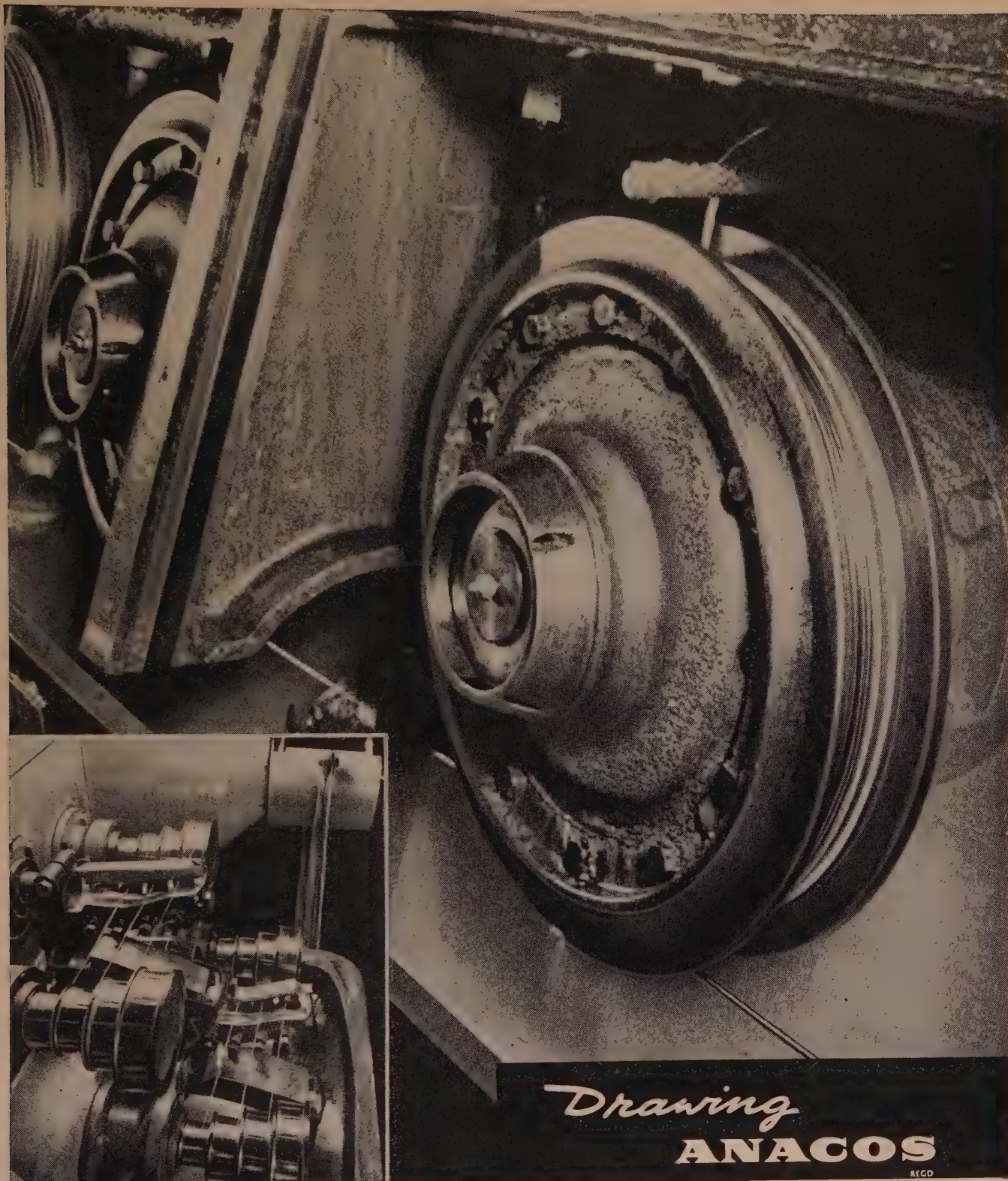
TYERS

LIQUID GAS FURNACE

Actual Manufacturers of
Oil and Gas Furnaces since **1885**
As used and approved by Electrical Authorities

THE PORTABLE FURNACE & PATENTS CO

CARRINGTON · NOTTINGHAM · ENGLAND
Telephone: Nottingham 64887 Telegrams: 'Furnace, Nottingham'



Drawing
ANACOS
REGD

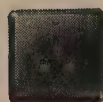
plain or tinned
down to 0.001"

copper wire

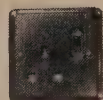


FREDERICK SMITH & COMPANY
ANACONDA WORKS SALFORD 3 LANC

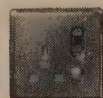
Whether it's a socket-outlet



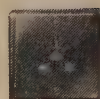
switchsocket-outlet



pilot-lamp switchsocket-outlet



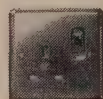
rated at 2, 5, 13 or 15 amperes



with brass plate finished BMA or matt chrome



or moulded in brown or ivory



whether it's a fused spur-box



with a switch



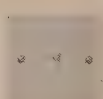
or a pilot-lamp



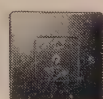
a water-heater switch



a one or two gang Plateswitch



or even a clock connector



MK make a design to fit the

standard box with $2\frac{3}{8}$ " centres



.....(and all the many 1 and 2 gang MK Gridswitch combinations also have $2\frac{3}{8}$ " centres)

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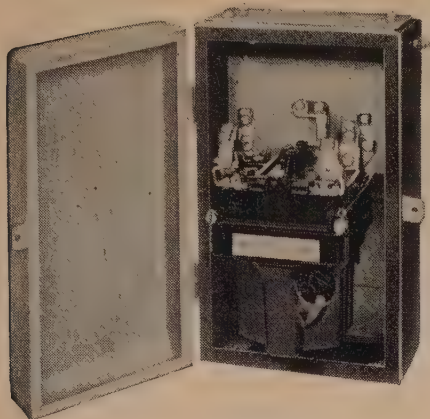
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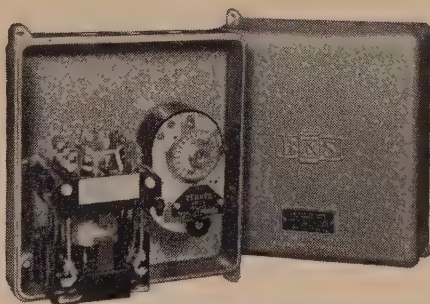
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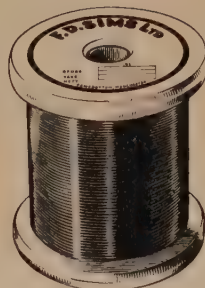
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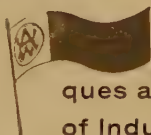
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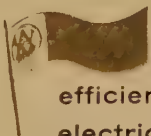
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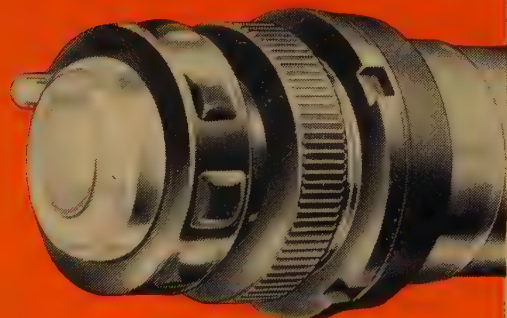
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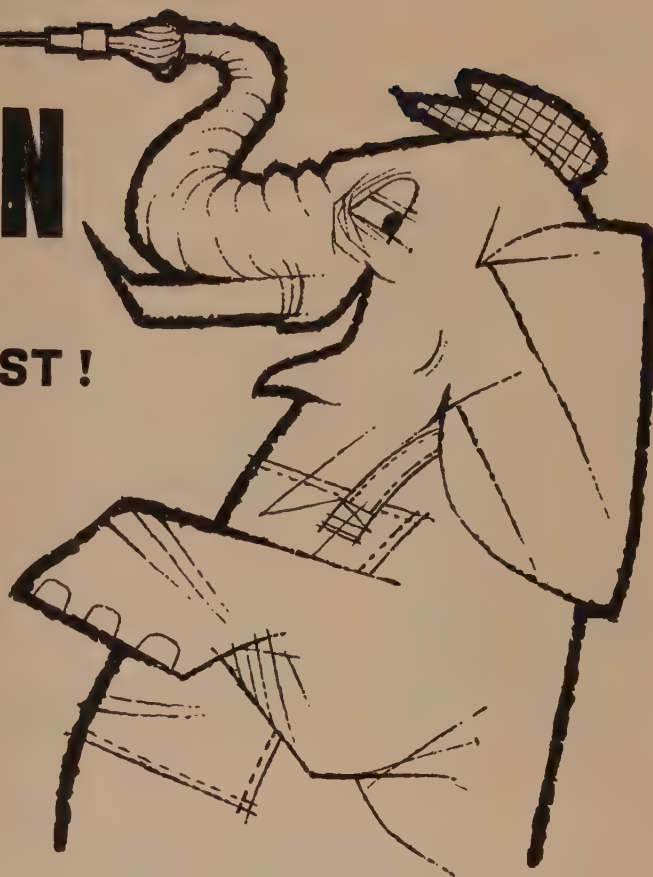
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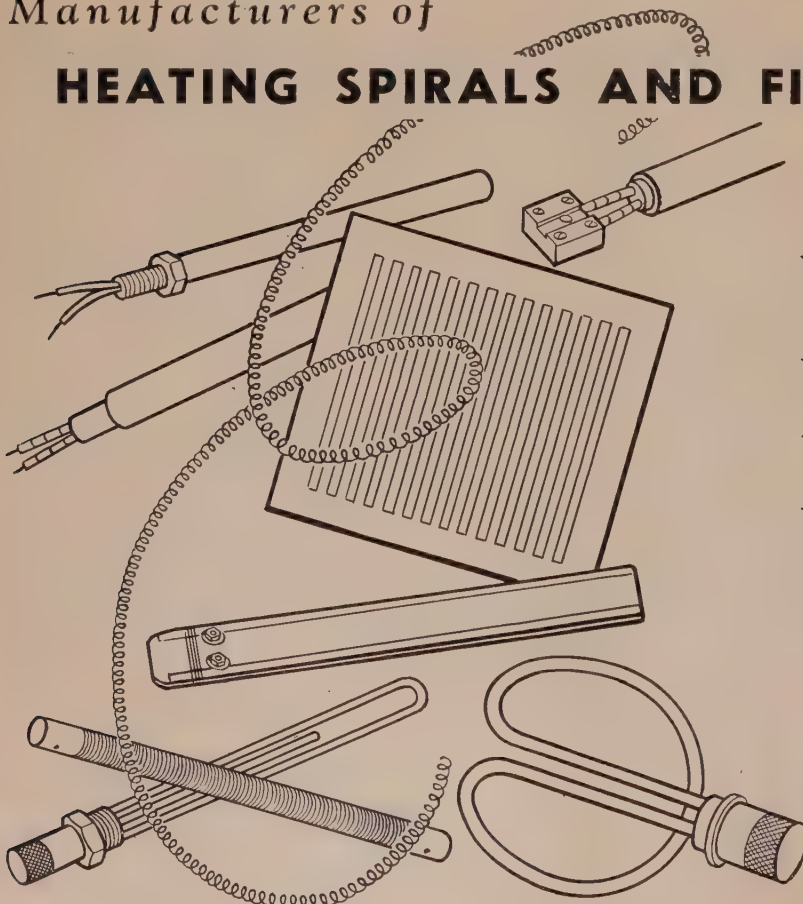


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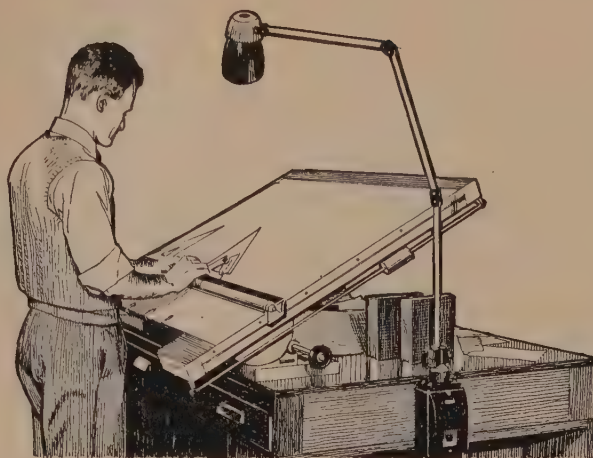
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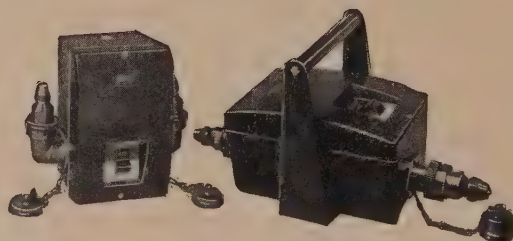
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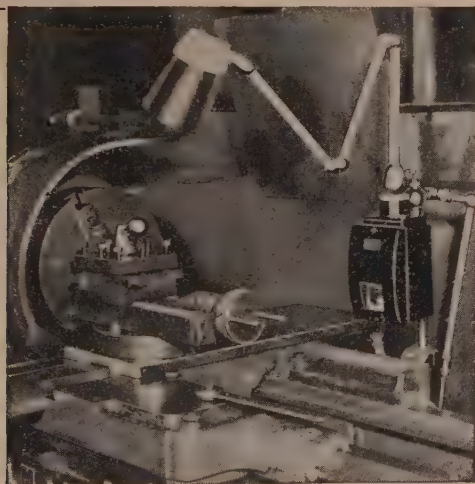


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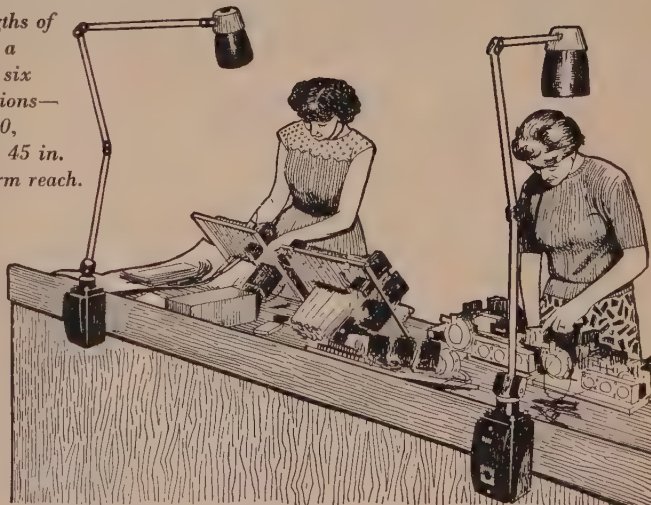
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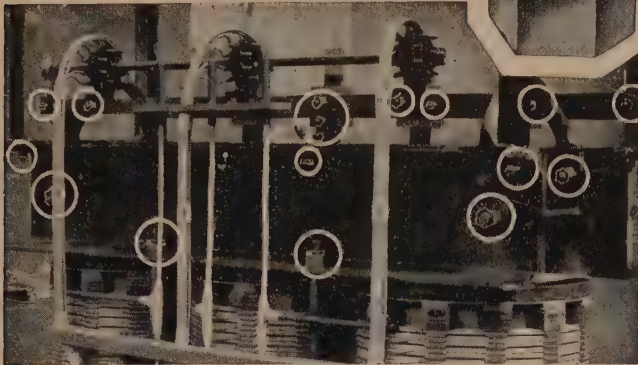
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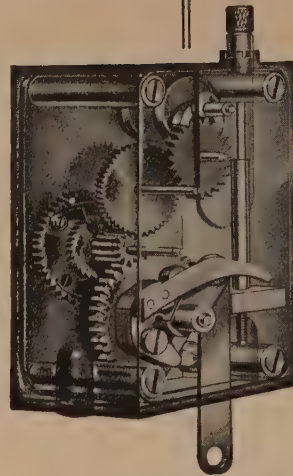
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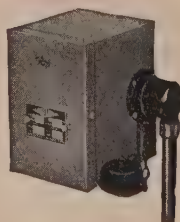
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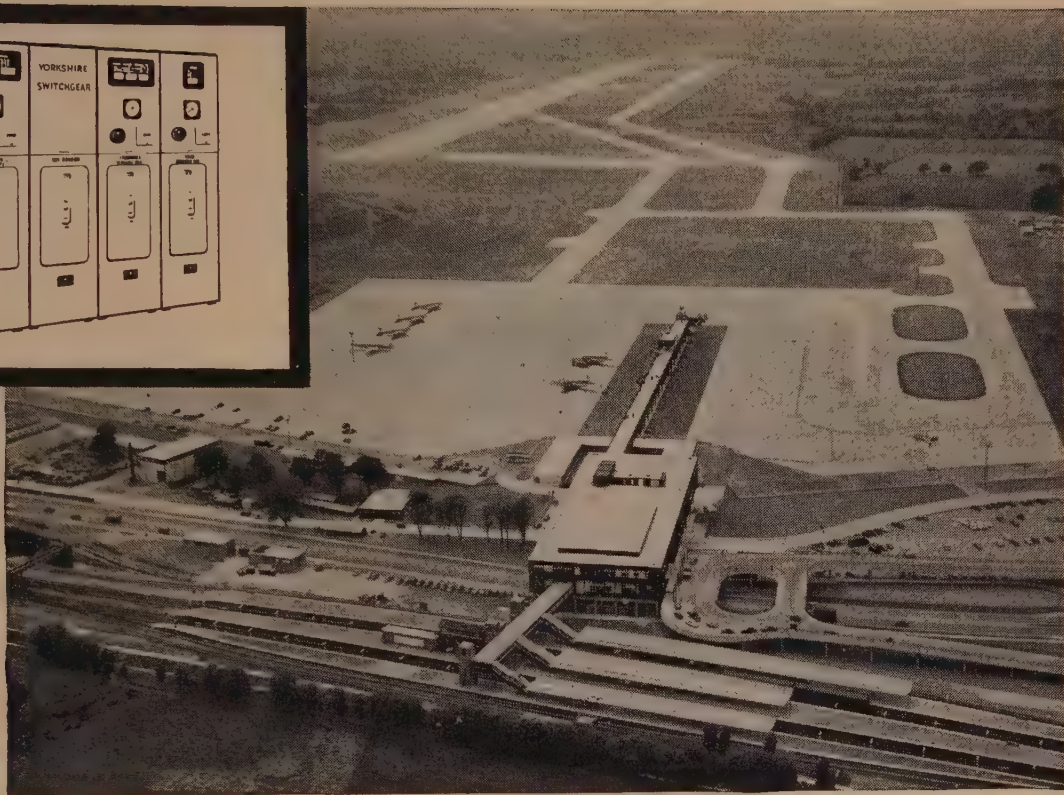
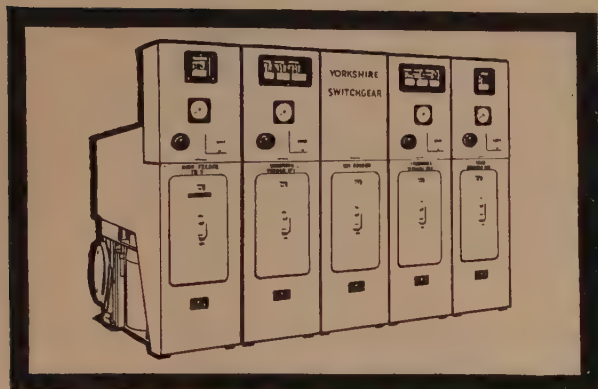


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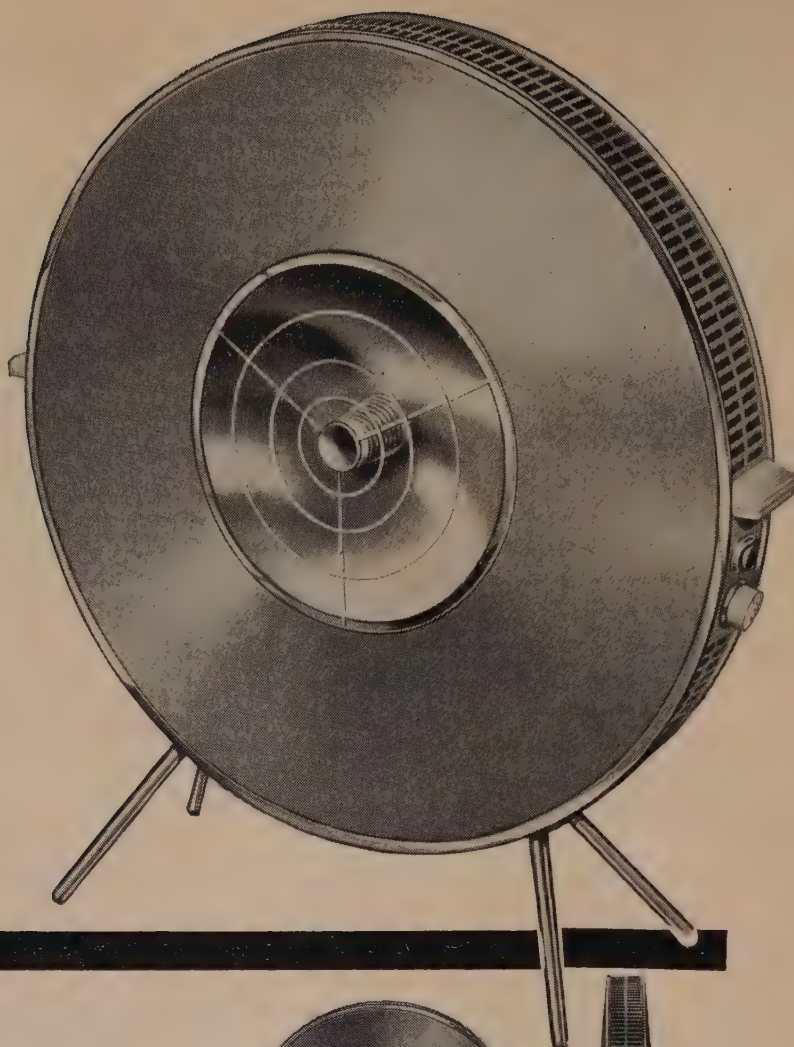
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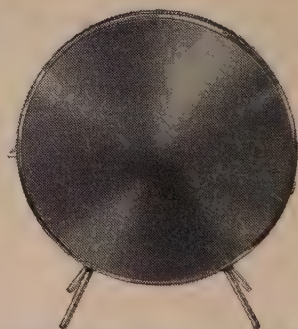


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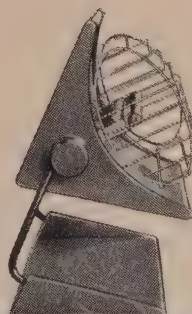
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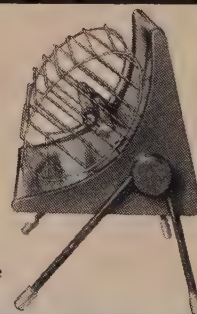
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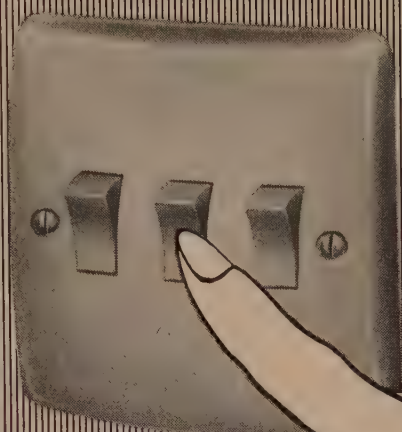
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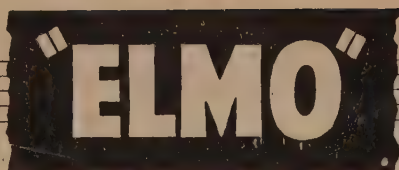
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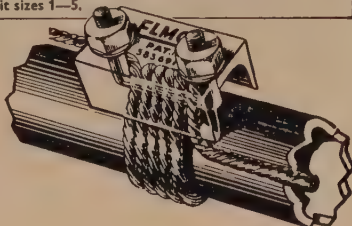
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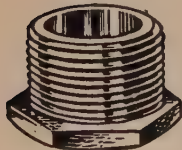
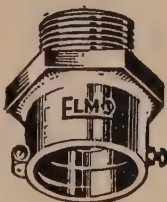
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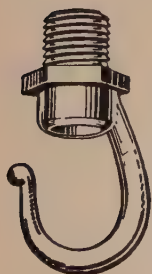
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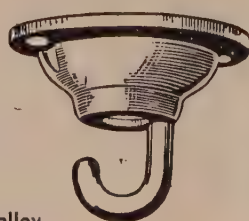
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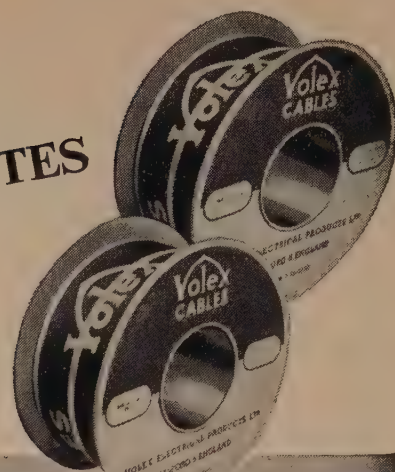
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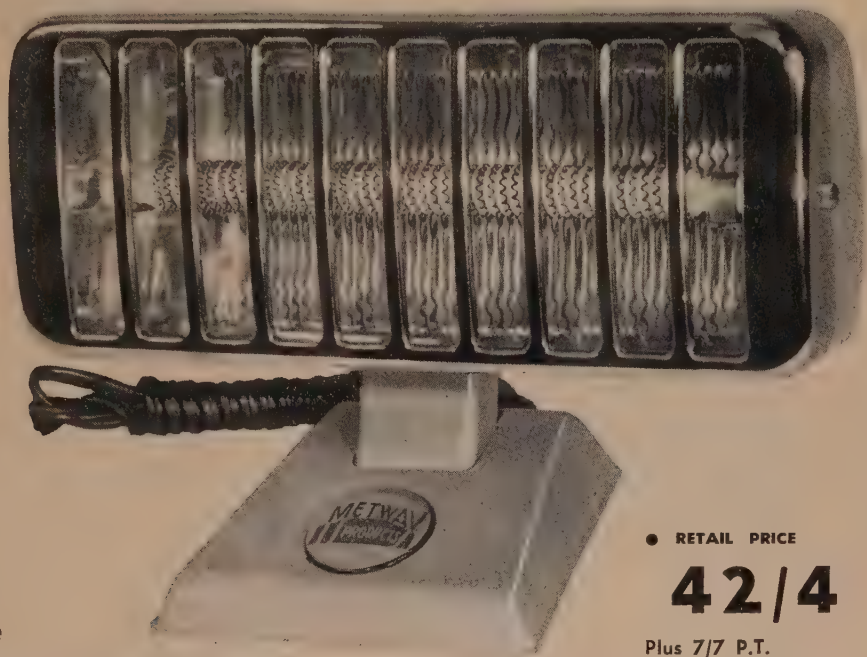
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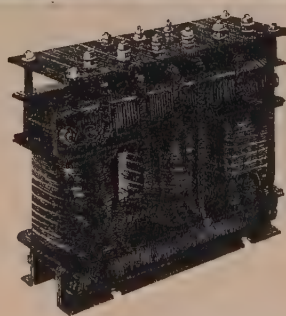
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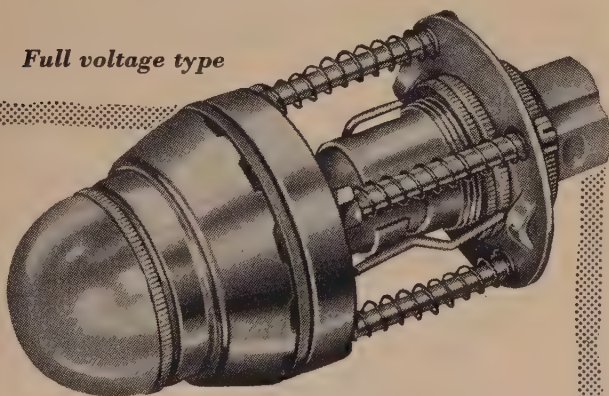
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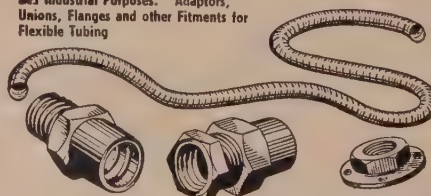


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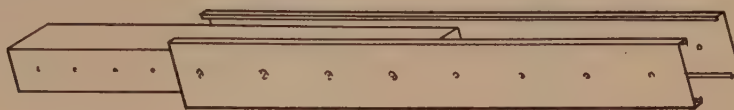
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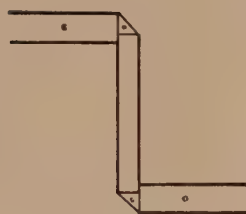
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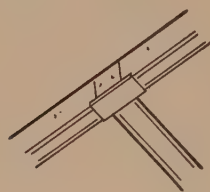
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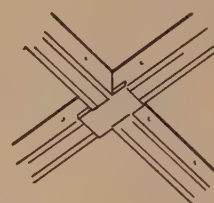
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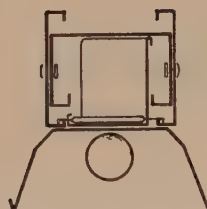
T joint



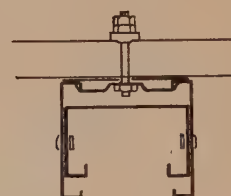
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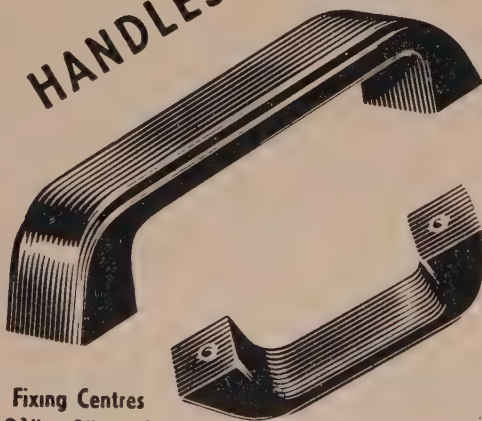
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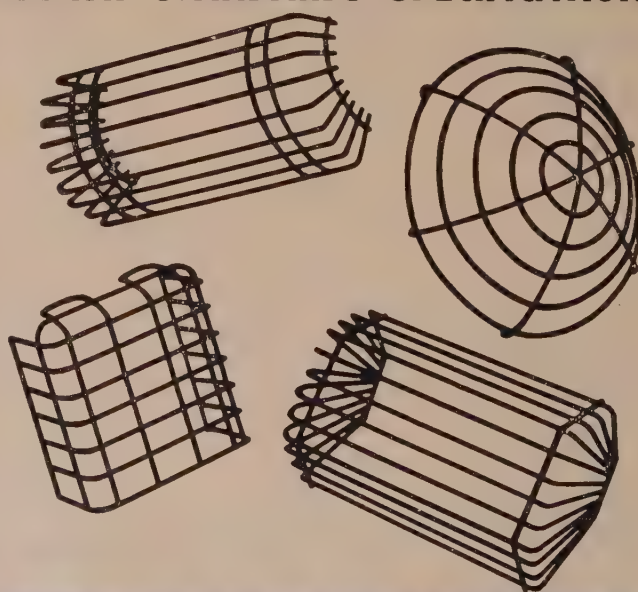
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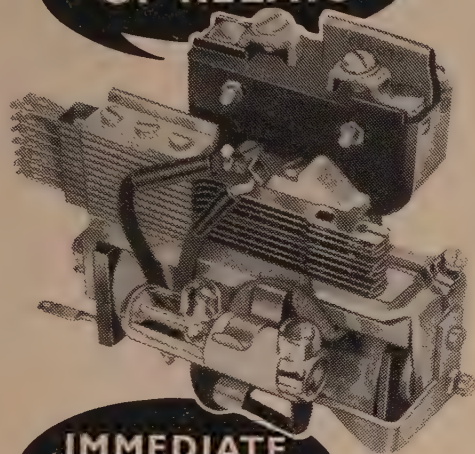
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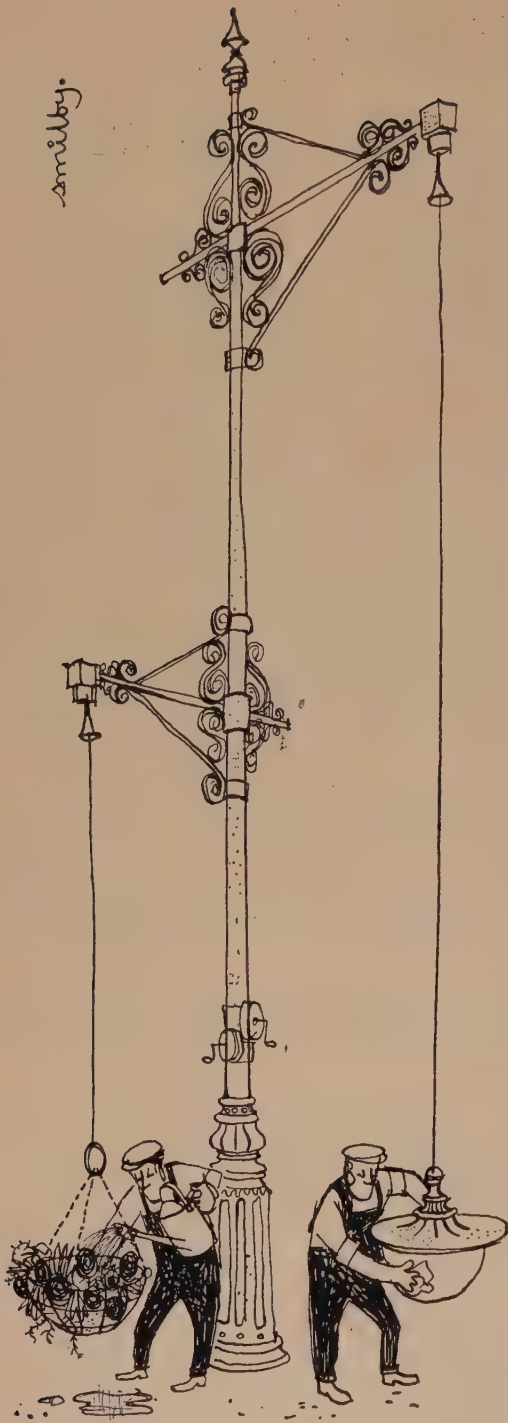
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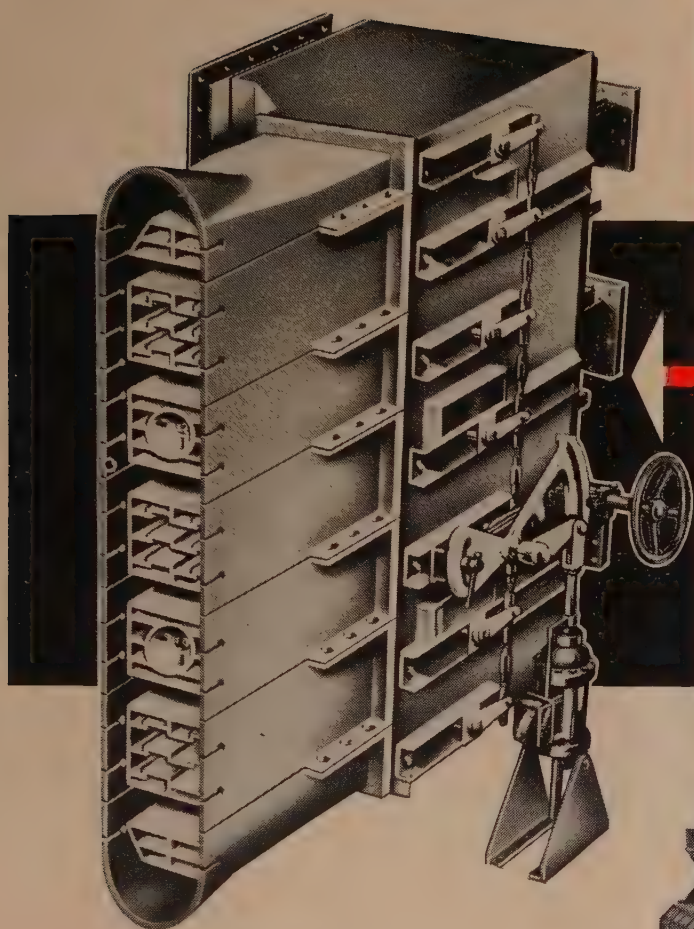
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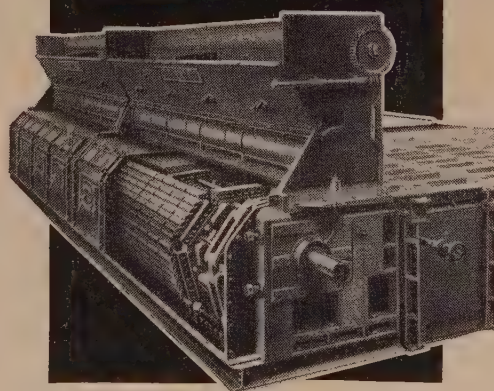
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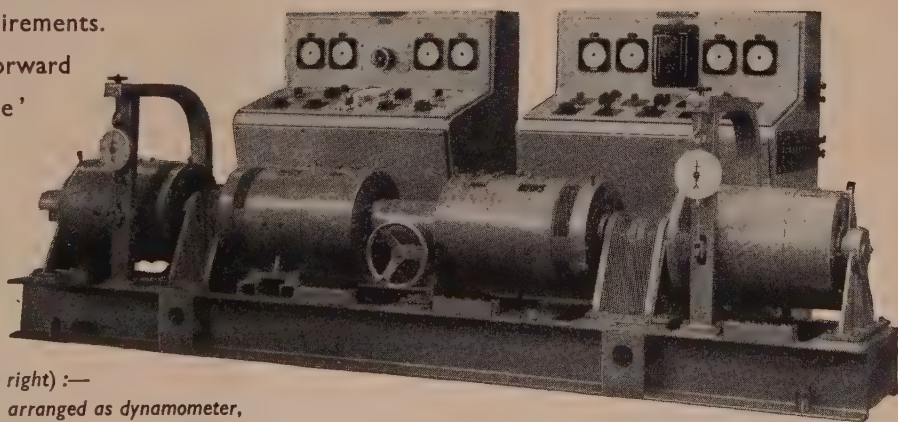


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Telephone: Hartlepool 5531

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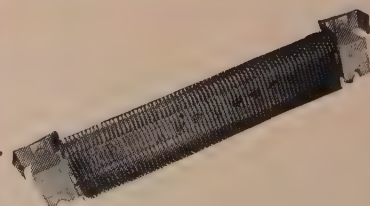
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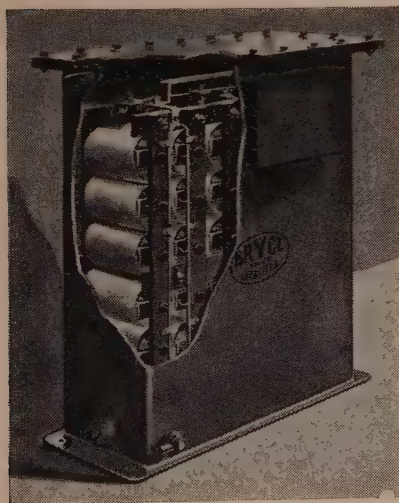
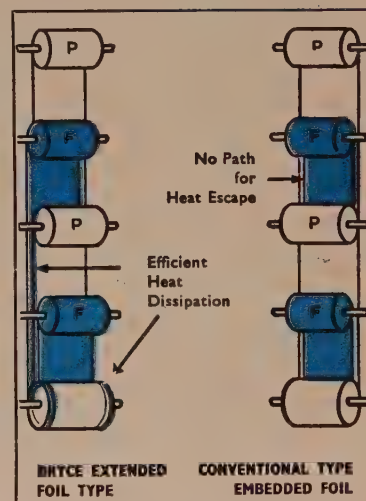
and inductive losses. Also this method is known to tend to give rise to internal discharges. The method of using a soldered connection from the foils, while overcoming these disadvantages, introduces the risk of damaging the paper dielectric by overheating.

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The current path is the most direct conceivable and the multiplicity of contact points provides insurance against faulty connection, even under the most severe surge conditions. Improved efficiency of the conducting path minimizes current densities and consequently keeps to a minimum the temperature rise due to this cause.

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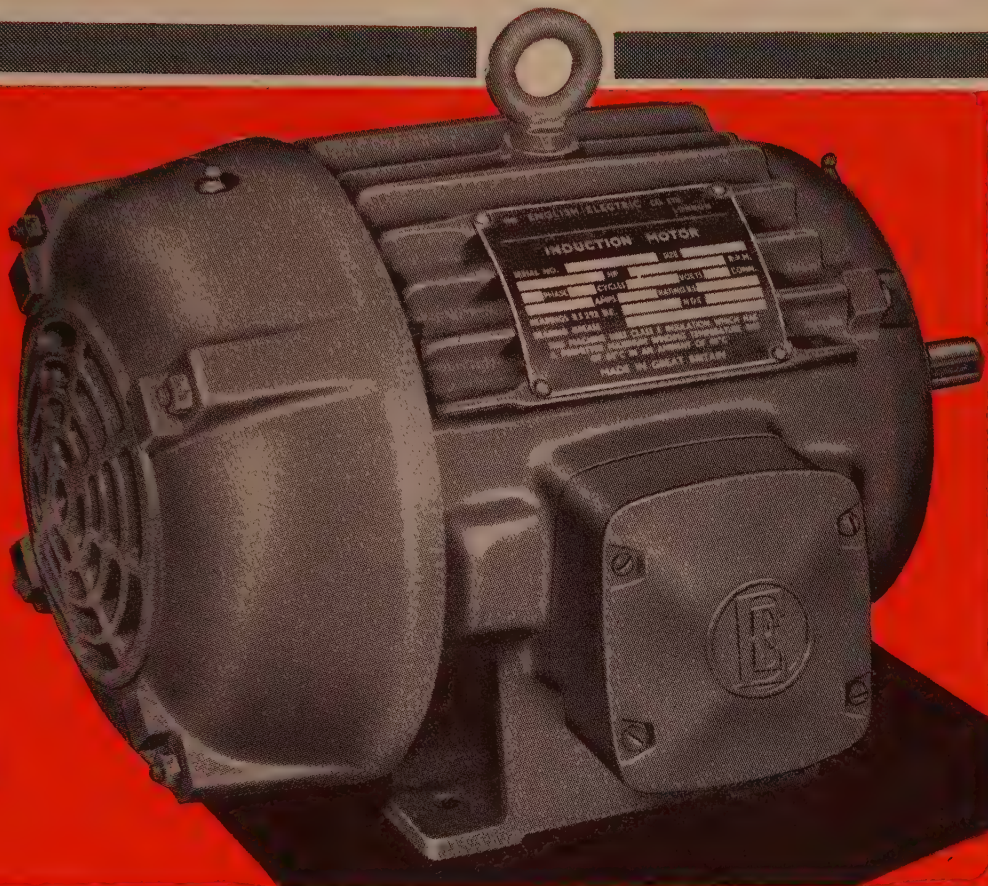
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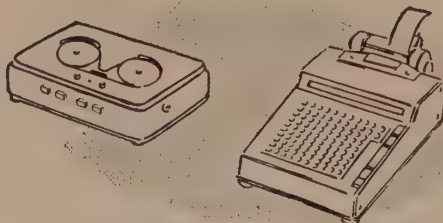
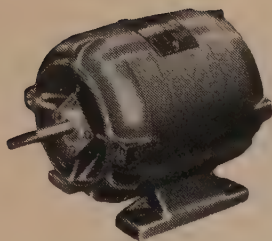
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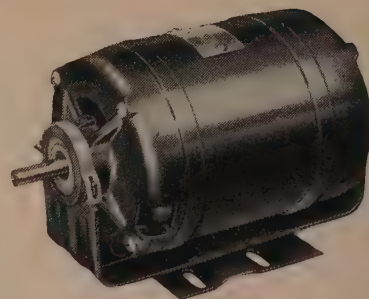
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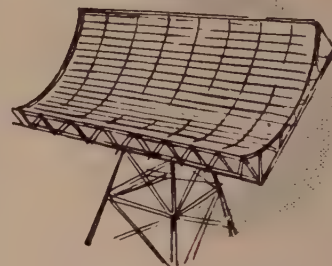


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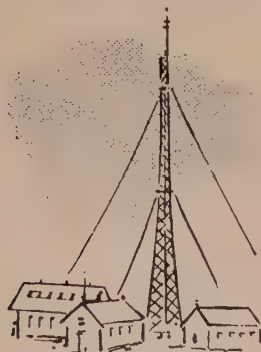
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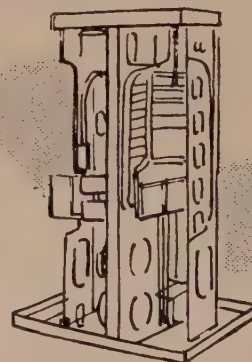
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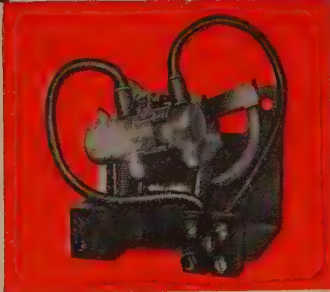


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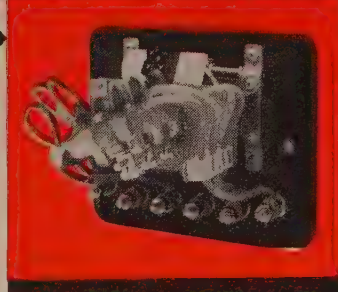
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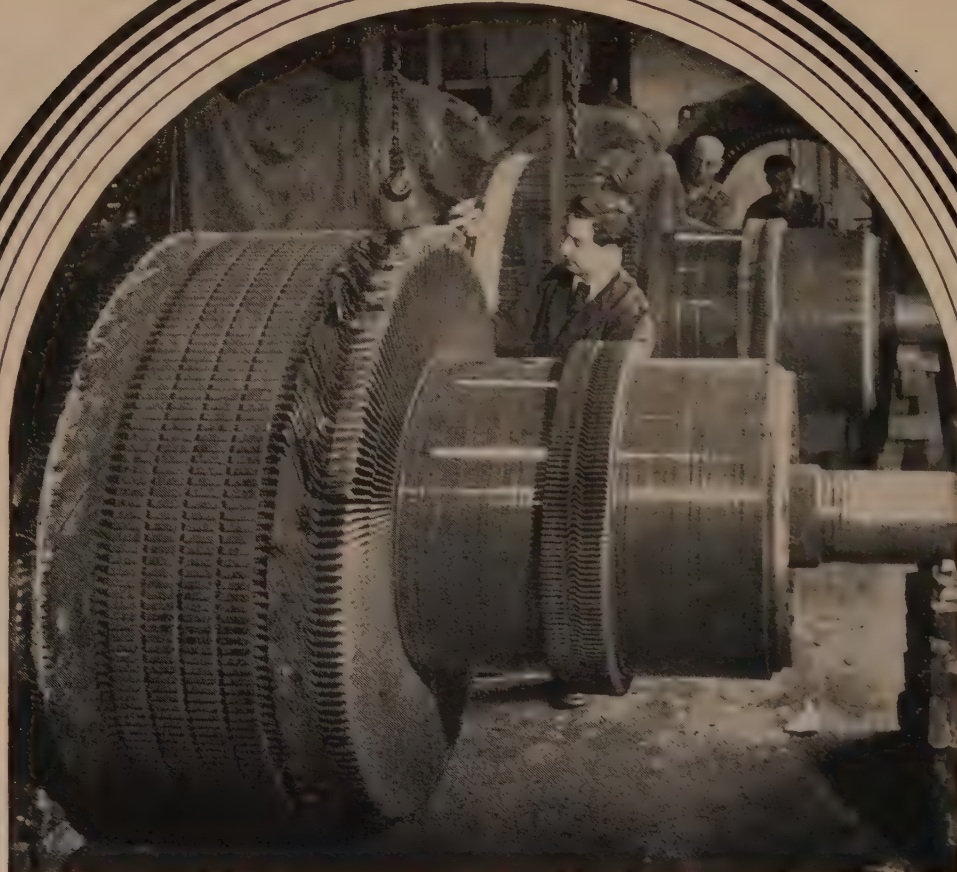
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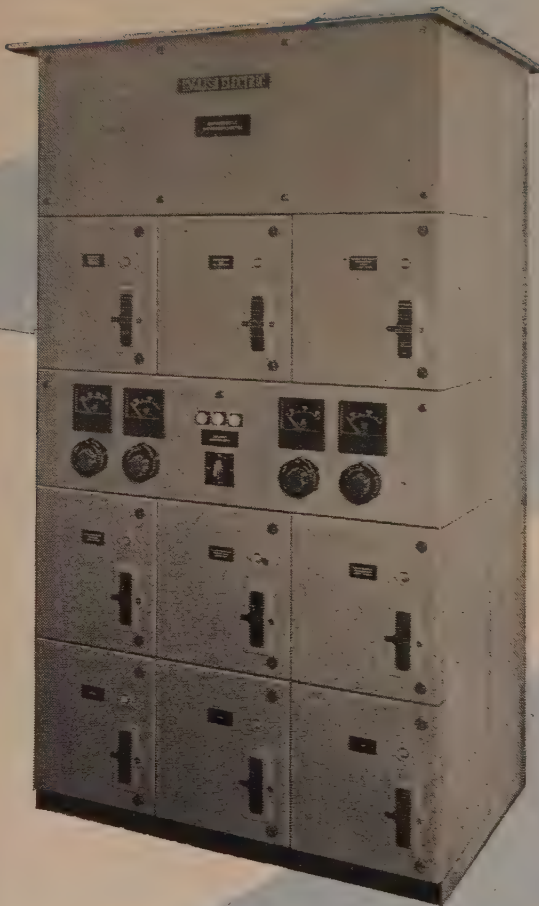
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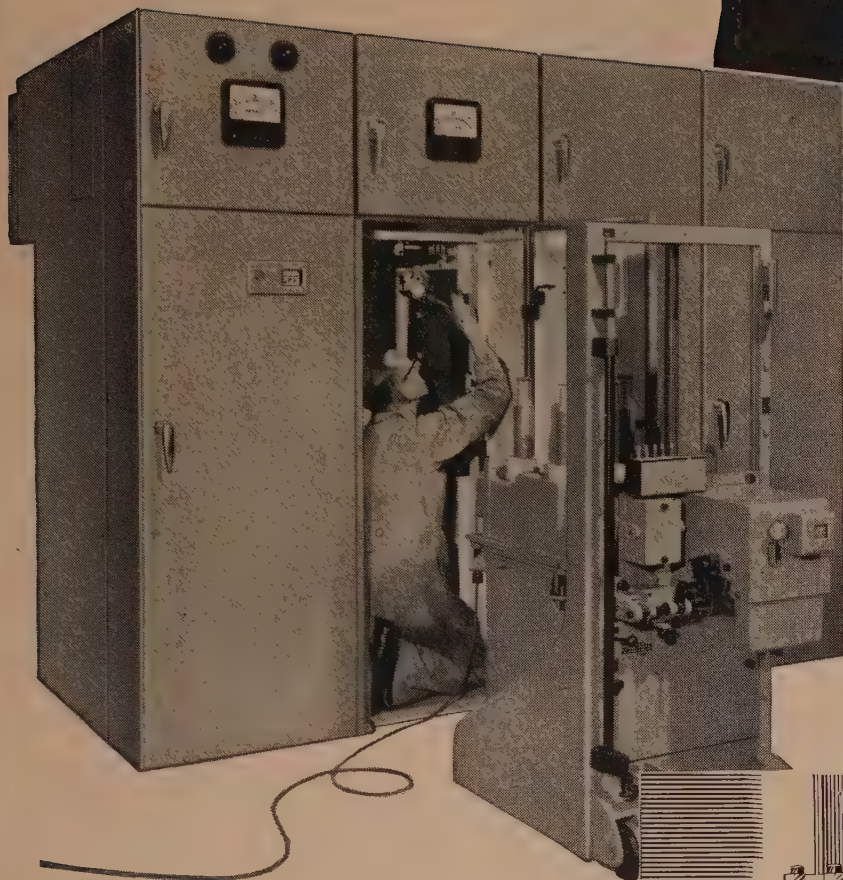
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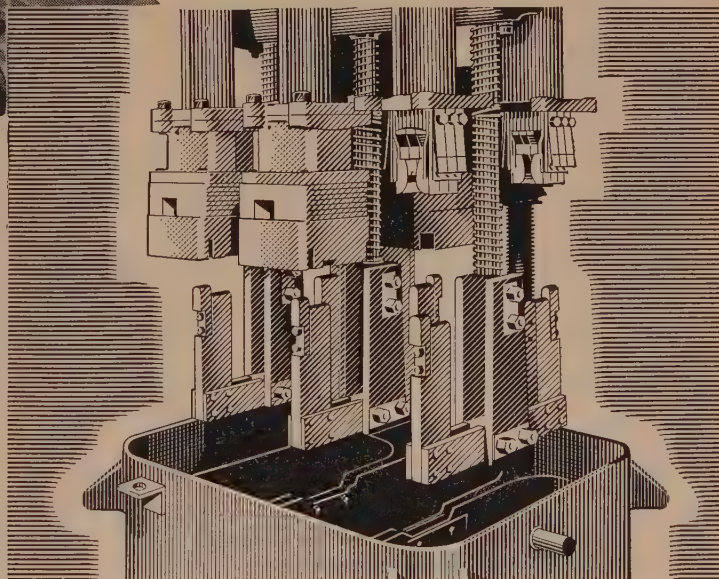
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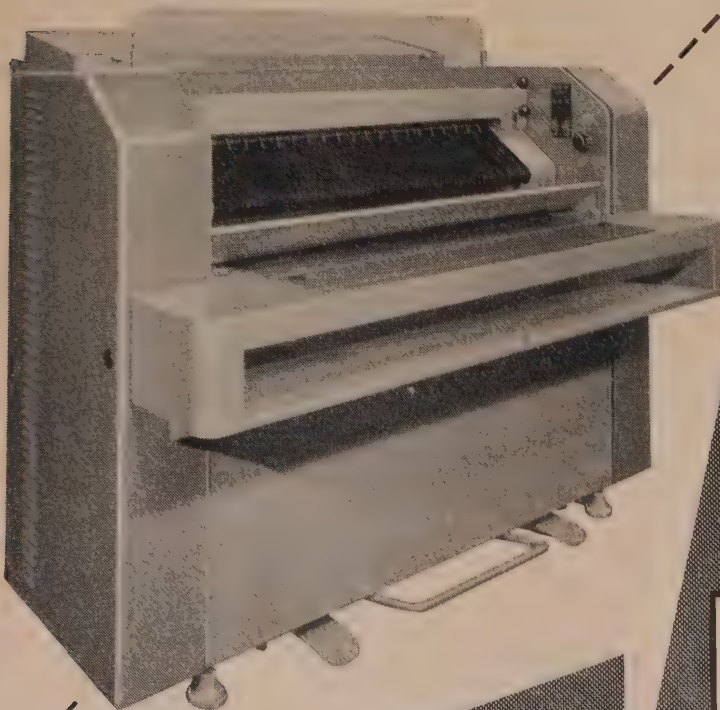
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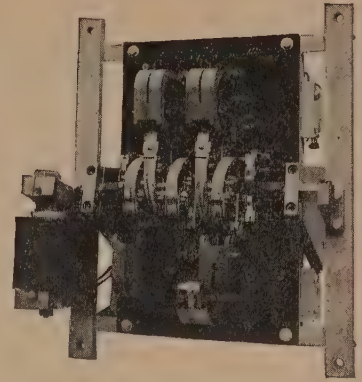
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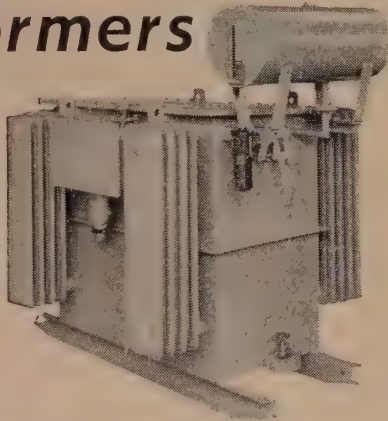
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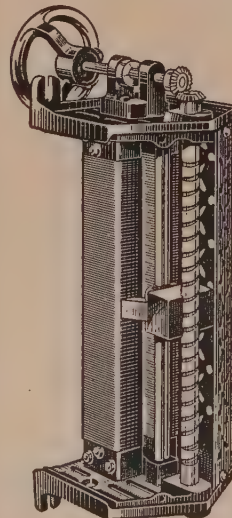
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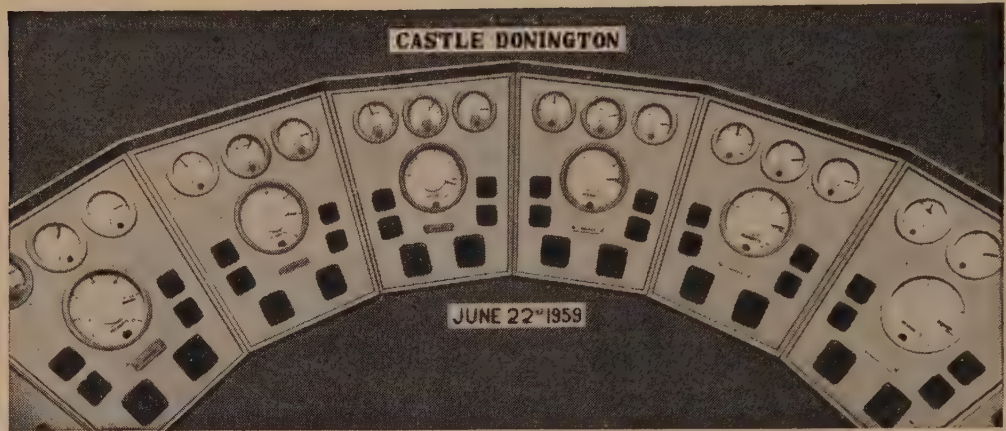
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Photograph showing
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99, 98, 99 megawatts.



102

100

102

99

98

99

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ELECTRICAL REVIEW

Managing Editor:
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A. R. POLLARD, A.M.I.E.E.

IN THIS ISSUE

A Decade of Achievement	1	A review of progress made in the electrical industry. An indication is also given of the likely trend of development during the next ten years
Extra-High-Voltage Insulators	3	Developments which have taken place in insulators to meet the demands of the 275 kV supergrid and other extra-high-voltage transmission systems are described
Inspection of Large Boilers	8	The various aspects of boiler inspection during construction, as part of the maintenance programme and for complying with statutory regulations, are discussed. An annual comprehensive external examination, in addition to the stipulated inspections, is suggested
Enclosed Fan-Cooled Motors	12	New motors, smaller and cheaper than existing machines of the same output, have been announced by three manufacturers
Earthing Practice	15	The author deals with the various methods of earthing equipment for protection against shock, fire and lightning. Reference is also made to the uses of different types of electrodes
Materials for the Electrical Industry	18	Annual review of supply, consumption and price changes of the principal materials used in the electrical industry—copper, tin, lead, zinc, aluminium, iron and steel, and rubber
Overseas Electrical Trade	21	In the eleven months to the end of November British manufacturers exported electrical equipment to the total value of £211.8 million, an increase of £8.5 million over exports in the corresponding period of 1958
Domestic Electrical Equipment—Dry Shavers	36	Survey of the range of types now available, including battery operated models for car owners and travellers. Details are given of weight, voltage range, special features, finish and price

◇ ◇ ◇ ◇

Views on the News	7	New Patents	40
Industry and the House	13	New Electrical Equipment	41
Generation and Development	23	Contract Information	43
Industrial News	24	Next Week's Events	44
Personal and Social	28		
Financial Section	32	CLASSIFIED ADVERTISEMENTS	87
Domestic Refrigerators	35	INDEX TO ADVERTISERS	96

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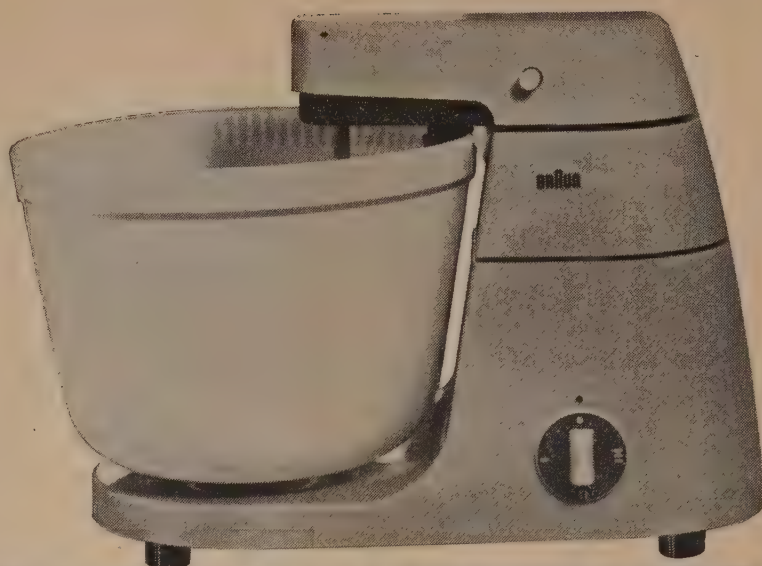
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ELECTRICAL REVIEW

1 January 1960 Vol. 166 No. 1 Established 1872

A Decade of Achievement

AS we enter the 'sixties of the twentieth century there is every indication that the electrical industry in its broadest sense will continue to make progress at a similar rate to that which it has done during the 'fifties. As measures of achievement during the past decade stand the facts that the total installed generating capacity in this country has increased by more than 10,500 MW and the amount of electricity sold has risen from 46,000 million kWh to about 90,000 million kWh annually. If this trend continues, and it is more than likely to do so, there will be a further doubling in the demand for electricity between now and 1970.

It may be questioned whether the electrical industry is likely to be able to provide this amount of power, which will mean installing generating plant to the tune of nearly 2,500 MW of plant each year. We would say without reservation that it will be done. Ten years ago we were installing generating plant at the rate of not much more than 500 MW a year, mainly made up of 30 MW sets with a few 60 MW units. Now there are units of 100 MW, 120 MW and 200 MW in operation. During the 1960's units of 200 MW, 275 MW, 300 MW, 350 MW, 550 MW and possibly even larger, will be put into service in conventional thermal plants. In addition, the first group of civil nuclear power stations will be completed and the construction of others will begin. The cost per kW of installed generating plant capacity has been reduced considerably during the past ten years despite rising costs of both labour and materials. This has resulted from improved design techniques, coupled with the Central Electricity Generating Board's policy of ordering generating units of ever larger individual capacity.

There is no doubt in our mind that the demand for electricity will double between now and 1970 and it is likely that electricity will supplant other forms of fuel in many spheres of activity but particularly in space heating and rail traction. On the domestic side there will undoubtedly be a greater demand for labour saving devices. Furthermore, if suitable tariffs are offered by supply authorities the load presented by domestic heating schemes is likely to assume massive proportions. A week or two ago the first 25 kV, 50 c/s a.c. main-line electric locomotive was delivered to British Railways and by 1970 there will be a national main-line network of railways supplied with power direct from the grid system. Industry generally continues to expand as demand increases for such things as motor-cars and

equipment of all kinds. This in turn means an increase in the demand for steel and one large steel manufacturing concern has decided to scrap its open hearth furnaces and install electric arc furnaces in their place, and we can expect other steel makers to follow suit before very long, creating an enormous additional electrical load. In almost every section the electrical industry has done very well in recent years and there is every sign that it will continue to advance indefinitely.

ENGINEERING MANPOWER REPORT

The report on the second survey of the number and distribution of scientists and engineers in Great Britain to be carried out by a sub-committee of the Advisory Council on Scientific Policy has recently been published. The first report was produced in 1956 and a comparison shows that the number of qualified men both employed and completing their training increased generally during the intervening three years rather more rapidly than had been anticipated. Most industry groups showed large proportional increases in some but, where the actual recruitment had considerably exceeded the requirements forecast in 1956, the expected demands for the next three years had been reduced. Nevertheless, it is expected that a shortage of scientists and, rather more acutely, engineers will still exist in 1962.

In some other groups recruitment fell substantially short of the 1956 requirement forecast. Chief among these was electrical engineering, where the number of qualified men employed increased by 9.7 per cent to 13,380 instead of rising by 43.2 per cent as expected. That this requirement was not unduly optimistic can be seen from the new forecast of an increase of 36 per cent by 1962. The report suggests that possible causes of the variations between industry groups are differing economic circumstances, difficulties in obtaining specialists, and the varying attractiveness of industries competing for an inadequate supply of scientists and engineers. In electrical engineering certainly the prospects offered by such a rapidly expanding industry cannot be regarded as unattractive and economic circumstances have been at least satisfactory. The specialists available to an industry covering such a wide field may, however, have been fewer than desirable. Comfort can be taken, however, from the report's next suggestion that certain employers may have understated their requirements in 1956 since they considered it unlikely that they would be able to recruit the scientists and engineers they needed.

HOPE FOR A NEW TUBE

No one who has experienced travel conditions in central London in recent weeks will question the urgent need for action to relieve congestion and to make the daily journey to and from work tolerable, if not comfortable, again. Emergency measures, like the Pink Zone, have some immediate effect but work on more ambitious schemes to cater for known, and inevitable, future growth is long overdue. For instance, electrification of the suburban services into the northern main-line termini will bring a big increase in traffic that will have to be absorbed in the centre by tube and bus services which are already seriously overcrowded.

Having studied these and other factors, such as the road works already planned, the London Travel Committee have concluded that the proposed new Underground from Victoria to Walthamstow is "essential to meet present and future demands for travel on the Underground system." They have accordingly recommended to the Minister of Transport that work on it should be started forthwith, even though it is not at present a "profitable commercial investment." As they point out in their report ("The Victoria Line," H.M. Stationery Office, 2s 6d), the expected "loss" is small (about 4 per cent) compared with London Transport's total receipts. It must also be remembered that the existing Underground railways do not pay their way and yet without them travel conditions in London hardly bear thinking about. The "losses" caused by present congestion cannot be measured, and the average annual expenditure of £9 million spread over six years would not make excessive demands on the country's capital resources. It is to be hoped, therefore, that the Government will now recognise that the provision of an efficient and adequate public transport system in the capital is more important than the profit on paper of the British Transport Commission.

NUCLEAR POWER STATION SITES

In the 16th report of the Royal Fine Art Commission, which has just been published by H.M. Stationery Office (price 1s 3d), the opinion is expressed that our countryside is threatened by demands for such things as motorways, generating stations and transmission lines. The report goes on to say that the countryside cannot be immune from change. We are in complete agreement, because it is difficult to see how we could otherwise improve our communications and raise the general standard of living.

The Commission is disturbed by the fact that the reactors in nuclear power stations will probably be exhausted after about thirty years but are unlikely to be then removed because of the risk of contamination. We would suggest that it is not so much a matter of contamination risk; it is quite possible to dismantle an extinct reactor but it is a very expensive business and its scrap value is unlikely to make it worth while. However, during the next thirty years or so it is not inconceivable that some means of overcoming this problem will be developed. In any case, if the public did not (quite properly) demand increasing quantities of electricity, then these problems might never have arisen. In conclusion, however, we would emphasise that we do not condemn the work of the Commission, for it has offered valuable advice on questions of public amenity for the last quarter of a century.

ELECTRICITY SUPPLY ORGANISATION

Next week's issue will include a revised version of the chart, first published in March, 1958, showing the organisation of the electricity supply industry. Readers requiring extra copies of this issue should make early application

Extra-High-Voltage Insulators

REVIEW OF RECENT DEVELOPMENTS

By **W. G. ROBINSON**,
B.Sc.Tech., A.M.I.E.E.*

Characteristics of transmission line and post insulators for the 275 kV supergrid and other high-voltage systems are considered in relation to the relevant British Standard and the International Electrotechnical Commission recommendations. They are generally developments of well-proven types and no radically new designs have been found necessary

DURING the last ten years there has been a remarkable development throughout the world in high voltage transmission systems. Until recently the highest voltage in this country was that of the 132 kV grid which had been in operation for almost thirty years. Since 1955 a new 275 kV grid has been coming into operation to reinforce the 132 kV system. During the period up to 1940 voltages of 110, 132 and 220 kV were in use abroad and there was one 287 kV system in the United States. Since then a number of systems operating at 275 kV, 330 kV and 380 kV have been constructed or are nearing completion. It is, therefore, opportune to review the developments which have taken place in insulators to meet the demands of the 275 kV supergrid and other extra-high-voltage systems.

Insulator Characteristics

It is usual to specify the performance of insulators in terms of the following design tests: Power frequency dry withstand test or flashover test; power frequency wet withstand test or flashover test; and impulse withstand or 50 per cent flashover test with the standard 1/50 micro-second wave. There is no general rule on the relationship

of these test voltages to the system voltage but the International Electrotechnical Commission has made certain recommendations which give the following relationships over the voltage range under consideration. The minimum impulse withstand test must be 3.75 times the system voltage and the minimum power frequency withstand test must be 1.65 times the system voltage.

These characteristics are measured on clean insulators, but it is also necessary to take into account performance in atmospheres where industrial and sea salt pollution is present. Although much research has been done on this subject it has not been possible to devise a laboratory test suitable for inclusion in specifications to prove the performance of insulators under pollution conditions. The most satisfactory way of assessing the performance is to erect insulators on the site of a proposed system and observe the leakage currents with the insulators energised at normal working voltage. The tests should continue for at least one year.¹ Based on the results of such tests and on experience on the 132 kV grid, it is specified that insulators for use in this country should have a creepage distance of at least 1 in/kV of system voltage and that at least half of this should be protected from rain driving at right angles to the insulator axis. This does not apply to transmission line tension insulators which due to their horizontal mounting are less affected by pollution than vertically mounted insulators.

Provision of the specified creepage distance does not of itself ensure good performance and it is necessary to strike a balance between the amount of surface exposed to cleaning by wind and rain and the amount of enclosed surface. In addition, the ribs which are added to increase the creepage path must not reduce the wet flashover voltage below the specified figure. These considerations limit the creepage distance to about three times the overall length of an insulator with anti-fog sheds and to about twice the insulator length with plain sheds.

Over the range of voltages in question, the electrical characteristics and creepage distance are approximately proportional to the dry arcing distance, i.e., the shortest distance from the high voltage electrode to earth measured round the insulator. Fig. 1 shows the relationships and also indicates the minimum impulse withstand levels recommended by the I.E.C. for effectively earthed systems of nominal voltage 132, 275 and 380 kV. For many types of insulator, the dry arcing distance is fairly close to the overall length, so that Fig. 1 shows how the size of an insulator depends on the electrical characteristics and creepage distance required.

Another electrical characteristic which is often specified is the corona voltage. The insulator has to be free from visible discharge at a voltage which is usually fixed at 20 to 40 per cent above the phase to earth voltage. The object of this test is to ensure as far as possible that the insulators are free from discharges which would give rise

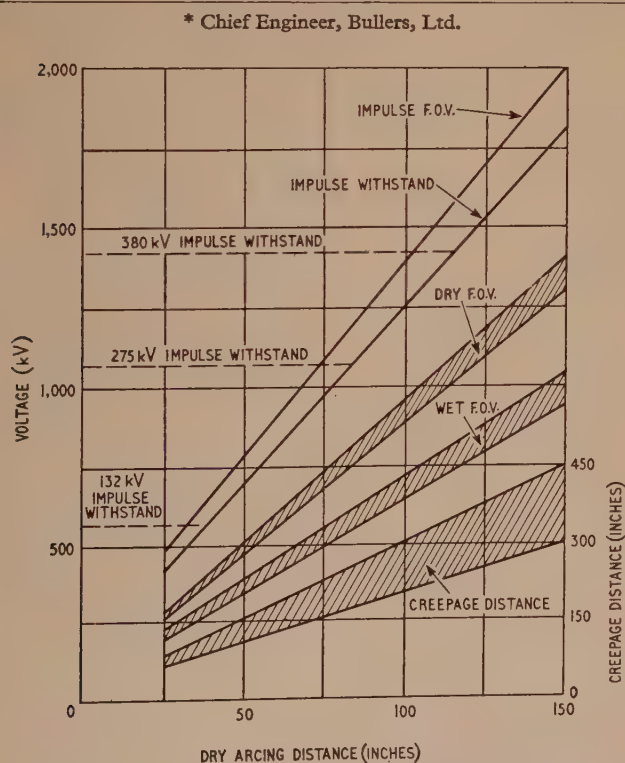


Fig. 1.—Relationship between insulator characteristics and dry arcing distance. The I.E.C. impulse withstand levels are shown

to excessive radio interference. This indirect approach is necessary until a laboratory method of measuring the interference from high voltage insulators is established and test levels can be laid down. Generally speaking the interference from e.h.v. lines is not serious and measurements in proximity to the 275 kV supergrid lines show quite low interference field strengths.²

In service, insulators are also called upon to carry considerable mechanical loads and the specifications give values of the various working and test loads for which the insulators must be suitable.

Transmission Line Insulators

The cap and pin insulator which has given such good service in all parts of the world on lower voltage lines has been adopted for almost all the extra-high-voltage lines. The only developments necessary have been the production of insulator units of higher mechanical strength and of greater creepage distance, and the design of stress control fittings and arcing devices for the insulator strings.

The mechanical loadings on e.h.v. lines are considerably higher than those encountered on lower voltage lines on

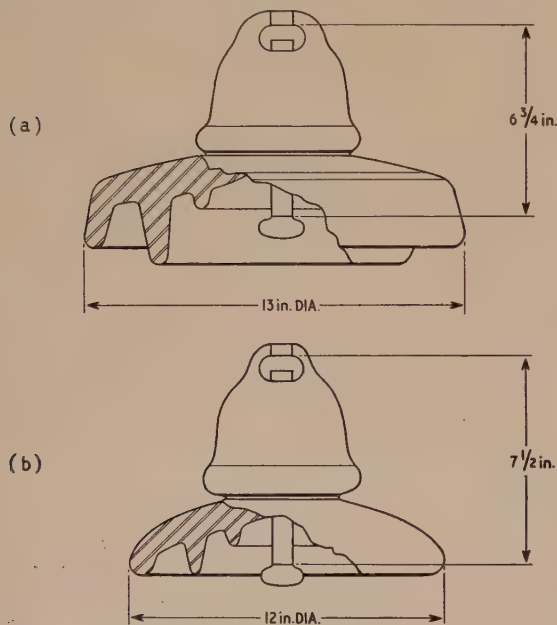


Fig. 2.—Cap and pin insulator units, 12,000 lb nominal working load.
(a) Anti-fog suspension unit; (b) Plain shed tension unit

account of the long span lengths and the use of large diameter single conductors or multiple conductors. It is possible to provide for these higher loads by the use of two or more strings of normal strength insulators yoked together, but the metal parts necessary to ensure proper sharing of the load in multiple insulator strings are complicated and expensive and they increase the overall length of the insulator strings. It is therefore more economical to use single strings of high strength insulators as far as possible. This is the practice on the British 275 kV lines where the twin phase conductors are carried on a single suspension insulator string and each conductor is separately attached to the tension tower by means of a single insulator string. The designed maximum working load on both tension and suspension strings is 12,000 lb on the lines using the 0.4 sq in copper-equivalent s.c.a. conductor.

Until the construction of the 275 kV lines, cap and pin insulators in this country were generally made in two mechanical ratings, 4,000 lb and 8,000 lb nominal working loads. These two ratings are used on the 132 kV grid

for the suspension and tension insulators respectively. British manufacturers of both porcelain and toughened glass cap and pin insulators developed insulators of 12,000 lb nominal working load and, as mentioned above, the use of these units has enabled the 275 kV lines to be constructed entirely on single insulator strings. British high strength insulators have also been used on e.h.v. lines in other countries. Fig. 2 shows typical insulator units.

The specification for overhead line insulators, B.S. 137, and the Central Electricity Generating Board specifications, require insulators to withstand a one-minute electro-mechanical test of $2\frac{1}{2}$ times the nominal working load without damage or appreciable distortion of the metal parts. In addition, the C.E.G.B. specifications call for a minimum breaking load of $3\frac{1}{2}$ times the nominal working load for tension insulators. To ensure interchangeability of insulators, B.S. 137 contains dimensions of the ball and socket couplings for 4,000 and 8,000 lb working loads. A standard coupling for 12,000 lb has been agreed, so that interchangeability of the new insulators and fittings is ensured.

It might be mentioned here that the rating of insulators on a nominal working load, which is used in this country, is purely an arbitrary method.* In the U.S.A., cap and pin insulators are rated on the electro-mechanical breaking strength and the national specifications provide for standard ball and socket insulators of 15,000 and 25,000 lb breaking strength. The 15,000 lb rating and its standard coupling corresponds closely with the British 4,000 lb working load rating. The 25,000 lb rating is comparable in strength with the British 8,000 lb working load types, but its ball and socket dimensions are smaller. There does not appear to have been any development of insulator units comparable to the British 12,000 lb types.

As far as the 275 kV insulator strings are concerned, the suspension sets consist of 16 to 18 units of the anti-fog type in series, the number depending on the creepage distance of the unit. The overall length is about 130 in. Tension sets consist of 15 or 16 units in series. When the 275 kV system was designed it was envisaged that the voltage of some sections might eventually be raised to 380 kV by changing the insulator strings. The suspension towers therefore allow for a length of 150 in. The development of insulators to give the specified creepage distance and other electrical characteristics within this limited length has already been carried out. Fig. 3 shows a 275 kV suspension set and a prototype 380 kV set.

To enable insulator strings for 275 kV and above to meet the requirements of the corona test and to have a satisfactorily low level of radio interference, it is necessary to fit some form of stress control electrode at the line end. This serves to limit the proportion of the voltage carried by the insulator units near the line end, to shield the yoke plates and other fittings and to protect the conductors in the event of a power arc. Arcing horns with looped ends have been found satisfactory at 275 kV, see Fig. 3, but for higher voltage it is necessary to fit more elaborate stress control devices to provide greater shielding of the metal fittings.³ Whatever the shape, the aim in design is to keep the dimensions transverse to the line at the minimum so that clearances to the tower are not reduced.

The only other insulator used on e.h.v. lines is the "Langstab" insulator which has been used for some years in Germany and Austria on 110 and 220 kV lines and has been used recently on a German 380 kV line. The insulator consists of a solid column of porcelain with projecting rain sheds. The high voltage types are made

* In a revision of B.S. 137 now under consideration it is proposed to discontinue the practice of rating insulators on the nominal working load. Insulators will in future be rated on the minimum failing or breaking load.

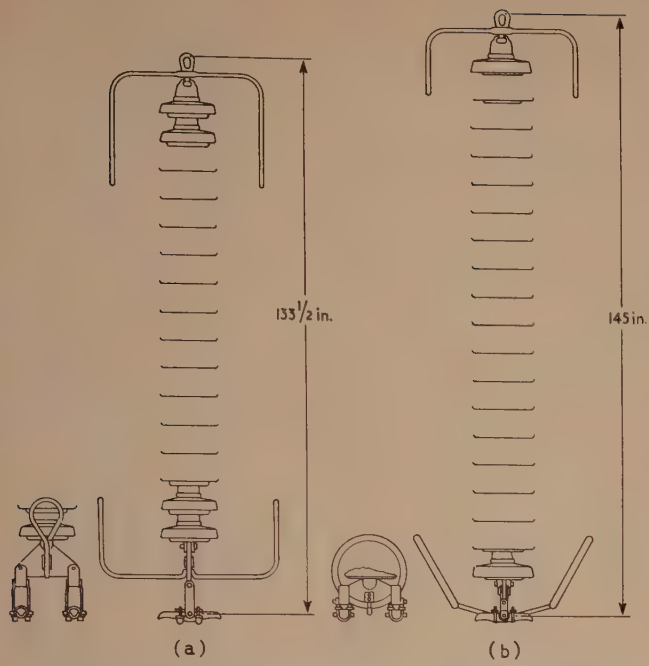


Fig. 3.—Insulator strings. (a) 275 kV suspension set; (b) 380 kV suspension set

in units approximately 50in long, the standard having 14 sheds giving 75in leakage distance, and the fog type 27 closely spaced sheds giving 112in leakage distance. Three units in series of this latter type are used at 380 kV.

The German 380 kV line uses a group of four conductors per phase which are carried on two insulator chains in parallel at suspension points. The insulator units have a core diameter of 75 mm and a breaking strength of 18,000 lb. At tension points, the group of four conductors is yoked together and carried by three parallel chains of insulators having 85 mm core diameter and a strength of about 23,000 lb. The yokes connecting the insulator chains are designed to ensure proper sharing of the load in normal operation and to share the load between any two chains of insulators, should one chain break. The overall length at the suspension points, crossarm to conductor, is about 200in. An arcing ring is provided at each end of the individual insulator units to prevent damage by power arcs which might lead to mechanical failure. The ring and its supporting arms are designed so that electro-magnetic forces produced by the arc current direct the arc away from the insulator.

Solid core insulators of the suspension type are manufactured in this country and were installed on a 66 kV line in 1941, but their use has not developed for the higher voltages for a number of reasons. This type of insulator does not seem to work as well as the cap and pin insulator under the pollution conditions experienced in this country, the overall length of the insulator string is greater, particularly with the multiple strings required for e.h.v. lines and finally the service record of British cap and pin insulators has been so good that there has been little incentive to change to other types.

Post Insulators

Post insulators are used in outdoor switching stations to support busbars, in the construction of isolating switches and as supports in air-blast switchgear. They are called upon to withstand bending and torsion loads and comparatively small tension and compression loads. The main types of insulator are shown in Fig. 4.

The pedestal type insulator has been used extensively

at all voltages up to 220 kV. An insulator unit having a height of 14 1/2 in, a diameter of 17 in and a bolt circle of 5 in diameter has, by common usage, become a standard and is manufactured in many countries. It has been used on the 132 kV grid in stacks of four for clean areas and five for polluted areas, the bending strength of the stacks being about 1,200 lb. At the inception of the 275 kV supergrid, manufacturers of porcelain insulators were able to agree on the leading dimensions and characteristics of insulators of this type to give the higher mechanical strengths required. Three new units were introduced, a heavy duty unit having a 10 in diameter bolt circle, a lighter duty unit having a 7 in diameter bolt circle and a special conversion unit having a 7 in bolt circle cap and a 10 in bolt circle pin to enable mixed stacks of the two insulators to be assembled. To give the required creepage distance of 275 in, stacks of eight insulators in series are required. A stack intended for underhung mounting consists of eight of the lighter units and has a bending strength of 1,200 lb. A heavy duty stack intended for upright mounting consists of three of the 10 in bolt circle units, a conversion unit and four of the lighter units. The bending strength is 2,000 lb. These two insulator stacks are used extensively in the 275 kV switching stations.

To give the specified corona level of 20 per cent above phase to earth voltage, the upright mounted stack is fitted with a deep guard ring which reduces the proportion of the voltage carried by the line end units and prevents the formation of corona at the edges of the caps. A shallow ring suffices to keep the underhung stack free from corona. Fig. 5 shows the two insulator stacks.

Pedestal type post insulators are also used on a number of e.h.v. systems abroad. Atmospheric pollution conditions are usually not so severe as in this country and the number of units in series is decided by flashover test values rather than creepage distance. Stacks of six units in series are used on some 275 kV systems and eight-unit stacks are used at 330 kV.

The other post insulators shown in Fig. 4 consist

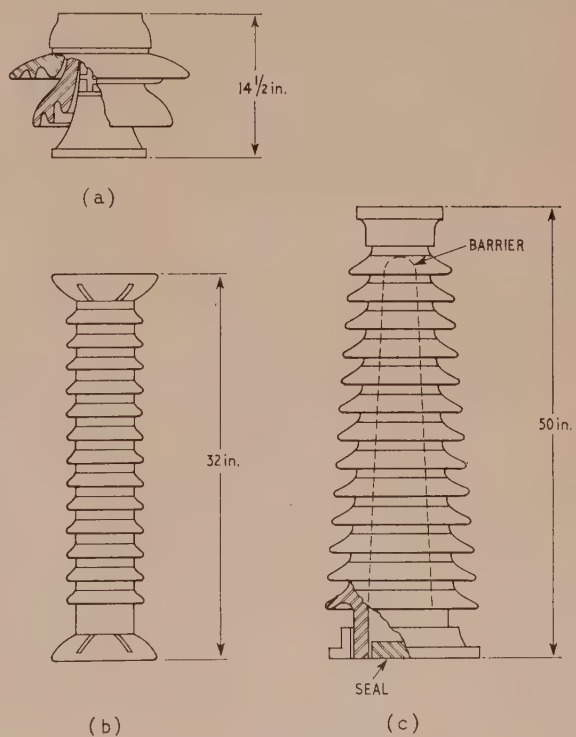


Fig. 4.—Post insulators. (a) Pedestal insulator; (b) Station post insulator; (c) Support insulator

TABLE 1

Insulator	Torsion Strength lb-in
Standard 150 kV Air Blast insulator	40,000
Standard 150 kV Air Blast insulator	100,000
Standard 150 kV Air Blast insulator	125,000
Standard 150 kV Air Blast insulator	200,000
Standard 150 kV Air Blast insulator	75,000
Standard 150 kV Air Blast insulator	120,000

essentially of a column of porcelain with a metal fitting at both ends and can generally be described as cylindrical post insulators. Two varieties of this insulator are used at extra high voltages.

The support insulator is made in large sizes so that a single insulator or an assembly of two or three insulators can be used up to the highest voltages. To prevent discharges down the inside, the bore of the insulator is closed by making the top solid or by means of an integral porcelain barrier. The correct operation of this type of insulator depends on keeping the internal space quite dry, otherwise moisture films can form on the walls of the cavity making them conducting and completely upsetting the voltage distribution over the insulator. For this reason the cavity is usually filled with a dry inert gas and closed by a seal at the bottom. In the case of support insulators used in air-blast switchgear, the barriers and seals are usually omitted since the bore of the insulator can be kept dry by a small flow of air from the circuit-breaker air supply. A large number of these insulators are incorporated on air-blast switchgear used on the 275 kV supergrid. They are similar to the bushing porcelain shown in Fig. 6.

The station post type of cylindrical insulator intended for use at extra high voltage is made in units 30 to 36 in high with metal caps to enable them to be bolted together in stacks. Internally the insulators may be hollow or solid. The solid construction avoids the necessity for gas filling and sealing but, for manufacturing reasons, the diameter is limited so that bending strengths of 275 kV stacks cannot exceed about 500 lb. The hollow type can be made in bending strengths up to about 2,000 lb.

The mechanical design of post insulators is generally

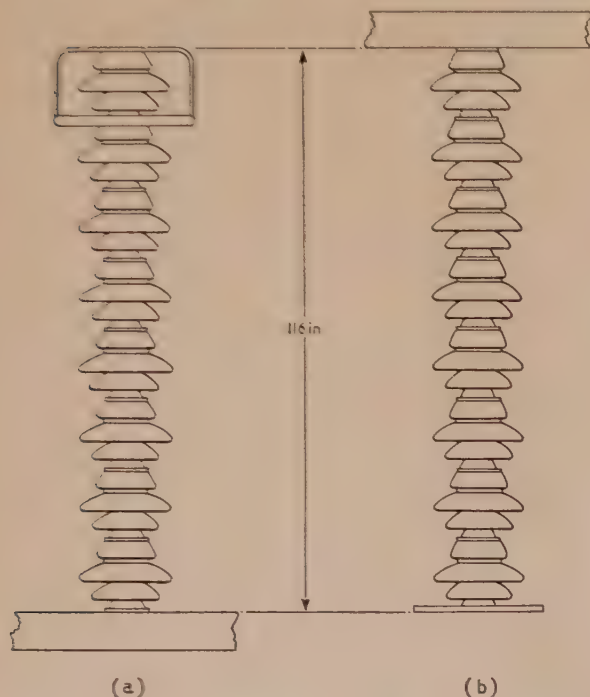


Fig. 5.—275 kV post insulator stacks. (a) Upright; (b) Underhung

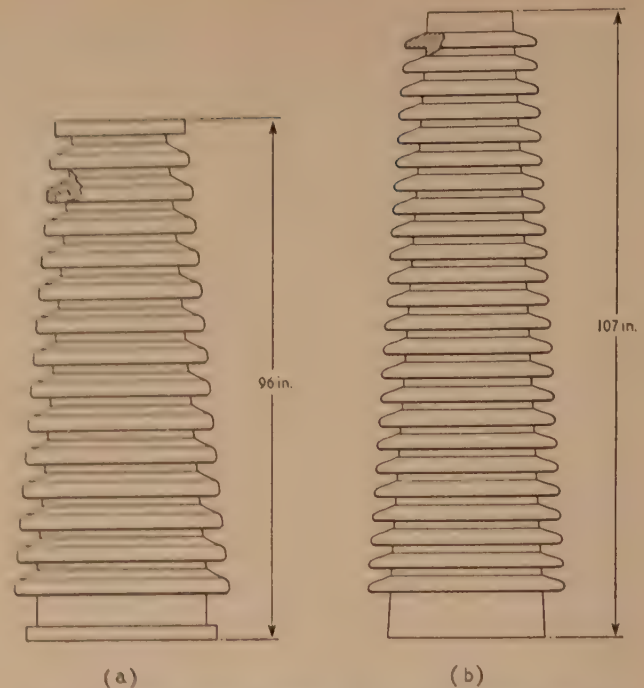


Fig. 6.—Porcelain weather sheds. (a) 275 kV anti-fog porcelain; (b) 330 kV plain shed porcelain

governed by the bending loads but torsion strength is also important in some applications. Table 1 shows the torsion strength of various insulators.

Porcelain Weather Sheds

Large porcelain weather sheds are used on the outdoor ends of bushing insulators and as containers for current transformers, capacitors and other apparatus.

A measure of standardisation of this type of insulator was achieved for the 275 kV supergrid by adopting a design of porcelain which was common to a number of items of equipment. This insulator is 96 in high, weighs 1,350 lb and has 14 anti-fog sheds, as shown in Fig. 6. Also shown is a plain shed porcelain used on a 330 kV system abroad.

The manufacture of these large porcelains presents problems on account of their size, but there appears to be no undue difficulty in making single insulators for voltages up to 380 kV. The question arises as to whether it might be more economical and more convenient for transport to make large porcelains in two or more parts which could be bolted together in the conventional manner by means of cemented-on metal flanges. Alternatively porcelains could be made in two parts and joined together by means of epoxy resin adhesives. Although these possibilities exist there seems to be a preference to use single insulators as far as possible. Further consideration will have to be given to this question when higher voltages are contemplated.

Conclusion

It will be seen that the insulators used for e.h.v. systems are generally straightforward developments of the well-proved types used at lower voltages and that no radically new designs have been necessary.

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VIEWS on the NEWS

By REFLECTOR

MOST of the difficulties of the electricity supply industry in finding sites relate to power stations and primary distribution lines. At least these are the matters which receive most attention in the Press. But, on a lower plane, there are multitudinous disputes about the siting of local distribution substations of which not so much is heard. People clamour for electricity supply but are singularly reluctant to grant the facilities for its provision. The December number of *Electricity* (the industry's monthly journal) comments on this subject, which it says is proving a "real headache" to the planning engineers of the Electricity Boards. Reference is made to the use of compulsory powers, but this must be regarded as a last resort; it is not a good means of fostering "public relations."

* * *

John Lear, in the *New Scientist*, tells of the use of plasma (ionised gas) as the rotor of an electric generator in place of the usual armature. This device has been used in the Avco-Everett Research Laboratory at Everett, Massachusetts, for a machine said to be capable of "generating more than 10,000 watts of power"; it is called a magnetohydrodynamic generator. According to the report it has fed a "blazing battery of 228 fifty-watt light bulbs" and can operate at 55 per cent thermal efficiency. It is very foolish to be too sceptical of entirely new ideas which may seem fantastic and so without comment I will quote the following account of the *modus operandi*:—

"The open cycle design is conceptually similar to a conventional combination of gas and steam turbines, scaled to deliver 450,000 kilowatts of power. In it, coal is burned in preheated air to push the temperature up. Gases from the furnace are first seeded with a tenth of one per cent of potassium to heighten electrical conductivity and then passed through the MHD generator, which converts three-fourths of the heat energy directly into electricity. The plasma flows from there into a heat sink, where the remaining energy is captured to condense steam to drive turbines to generate more power."

* * *

Since there is now a very strong feminine element in the electrical industry fashions have inevitably become one of the matters to which managements have to give serious consideration. Most staff and works magazines now devote a few pages to women's interests and I frequently hear of managing directors who are called upon to give their views on uniforms for their female employees. In such cases it is best to do as the English Electric Co. has done—run a competition among the female staff for the design of a new dress for the company's team of home economists and sales demonstrators. What was called for was "a practical and attractive solution to the

problem of choosing a style flattering to all age groups." This severe specification was satisfactorily met by Mrs. H. Mort, the company's home economist for the South Wales area, who secured the first prize from among over seventy entries. I will not repeat the details of her design, but I am sure that it will be very attractive—as no doubt the prospective wearers are.

* * *

Electrical life in the United States is much more exciting than it is here. If we have an Electrical Week it is a fairly sober local affair with a few demonstrations, lectures and films. In America there is an annual National Electrical Week and brief particulars of this year's were given in the *Edison Electric Bulletin* for November. It is to be held in February (to include the date of Thomas A. Edison's birthday—the 11th) and the theme will be "Electricity Sparks the 60s." The idea is "to dramatise the vital importance of the electrical industry to the nation's economy and progress." It is expected that more than 250 committees will be formed to carry out local co-ordinated programmes. One feature is the distribution of a "Planning Guide and Kit of Materials" throughout the electrical industry; last time some 4,500 of these kits were distributed to a selected list of people in all branches. Television and radio will be freely employed. There was once a thought that the British Electrical Power Convention would form the basis of a kind of national electrical week, but the publicity given to it by the newspapers is insufficient to fire the public's interest and support.

* * *

Lighting was becoming the principal application of electricity eighty years ago, but the arc lamp, in numerous forms, was still the only reliable illuminant. The *Electrical Review* of 1st January, 1880, made reference to a "sensational telegram received from America announcing the discovery by Mr. Edison, 'quite by accident,' of a new electric lamp, which is to do wonders." The *Review* expressed the opinion that:—

"The progress of the electric light during the year, though considerable, can hardly be considered to have been rapid. Certainly the progress and the results predicted have by no means been realised. Gas has not yet been, and is not likely to be, superseded as a whole by the electric light. The outside public, whose scientific knowledge is at the best but very limited, take fright very easily, and every new invention or display in electric lighting is regarded by them as another nail in the coffin of the gas companies; the latter are, however, a very long way off from being extinct, though there is undoubtedly great room for improvement in the quality of the article they supply."

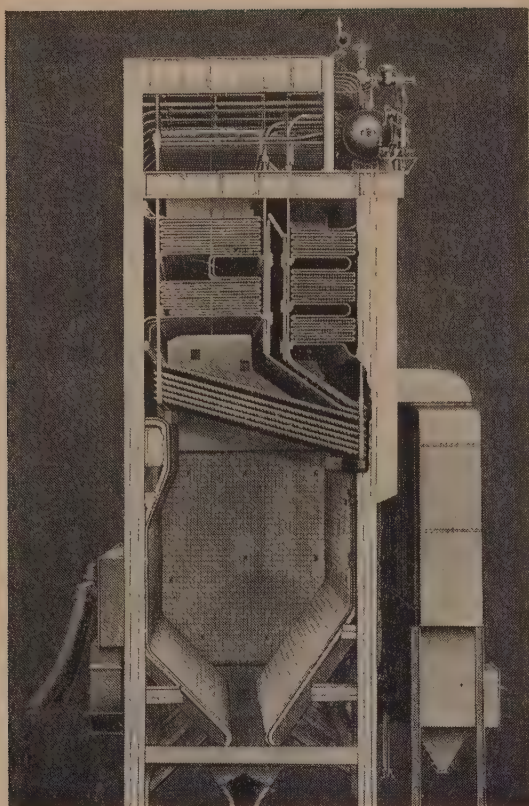


Fig. 1.—Sectional view of a straight tube boiler

BOILERS are increasing in size and their working pressures are advancing. Some having evaporative capacities up to 860 klb/hr were in service in British generating stations in 1958 and construction of 1,400 to 1,950 klb/hr units was under way, while even larger units have been ordered. Steam pressures up to 2,350 p.s.i. (in America up to 5,000 p.s.i.) and steam temperatures of over 1,000°F are features of the latest designs and are necessary for high efficiency when operating with large turbo-generator sets. For these conditions, many tubes of small diameter are required and careful inspection of the tubes and the other numerous parts is of major importance. The inspection work greatly exceeds that for shell boilers or smaller water tube boilers.

Boilers may have straight or bent tubes, the larger units being invariably of bent tube construction. A cross-sectional view of a 410 klb/hr header type boiler with straight tubes is shown in Fig. 1, a tri-drum bent tube boiler in Fig. 2 and a typical large radiant type power station boiler of 1,000 klb/hr in Fig. 3. Straight tubes are easier to clean, inspect and renew. Bent tubes have advantages because temperature expansions and contractions are accommodated by the bends without unduly straining the joints and other parts. As the tubes enter the drums at right-angles to the drum surface, the true cylindrical shape of the drums is retained, and expansion and bell mouthing are facilitated. Unless the utmost care is taken to exclude scale-forming substances and muddy particles from the feed water, sediment will accumulate, particularly at the lower bends. Both straight and bent tubes suffer from any non-sedimentary but corrosive feed water.

In modern large water tube high-pressure boilers, the superheaters and economiser are integral with the boiler,

INSPECTION OF

By G. BARNARD, A.M.I.E.E.

In this article the author describes the examinations that take place during construction at the manufacturers' works and on site, those carried out during normal maintenance and those required for compliance with statutory regulations. Although the regular testing of pressure parts is governed by statute, no stipulation is made for the whole plant unit, and an additional annual inspection is suggested

forming part of the tubing system. A large proportion of the tubes form the inner walls of the furnace, reducing the furnace volume and protecting the refractory coverings. There are also reheat sections connected between turbine stages. The volume of water in the complete boiler is small in relation to the evaporation rate, differing widely from the Lancashire type with its "flywheel" characteristic. Large water tube boilers can also successfully deal with fluctuating loads, their performance being sensitively responsive and highly efficient throughout the various loadings, provided their complex components, automatic controls and automatic safeguards are regularly inspected, tested and properly maintained.

Modern Inspection Procedure

The inspection routine for large steam generators can be divided into examinations during construction, inspections for compliance with statutory regulations, and inspections forming part of the maintenance programme. It is recommended that the practice of engaging an independent inspection authority to make examinations during construction and to witness commissioning tests be followed. Modern large water tube boilers are tall structures, the long tubes of which are brought to site in convenient sections and welded in position. Much building of the boiler is done during installation, entailing examination on site in addition to inspection of tubes, drums, elements, castings, headers, fittings, etc., in the manufacturers' works. A very high standard of welding is essential.

The major inspection duties in the works include checking the diameters and thicknesses of tubes against specified tolerance limits. Mechanical tests of tubes are witnessed, and all bent tubes are examined after forming to make sure they are undamaged. An example of difficult bends is given in Fig. 4. Steam and water drums are forged or fusion-welded. Forged drums are carefully examined at appropriate intervals from the ingot stage to final shape and again after machining, making openings for any standpipes and after the standpipes are welded in place. Internal and external inspections are important after machining the tube holes and finishing the drums. To assist satisfactory expansion and bell-mouthing, tube holes are usually recessed and may be

LARGE BOILERS

given up to eight circumferential grooves in the bore depending on the thickness of the drum wall.

Plates for fusion-welded drums are examined in the steelworks, test pieces being selected and their mechanical tests witnessed. Shell and end plates are inspected when shaped and with edges prepared for welding, and again during the welding of seams and standpipes. Radiograph films of the seams are taken and are critically scrutinised, calling for considerable experience and skilled interpretation. Further examinations are necessary after heat treatment of the drums and final inspections when the machining of the tube holes is finished and the drum is completed. Both forged and welded drums are examined during hydraulic testing.

After tube and hand holes are machined and any stub connections welded, the headers are examined and hydraulic tests witnessed. A few of the finished stud bolts are inspected after the threads are cut and nuts finished. Mechanical tests of the bars for stud bolts to suit high temperatures and high pressure conditions are advisable and should be witnessed. During installation frequent inspections of the various parts are made, great attention being paid to all welded joints and the bell-

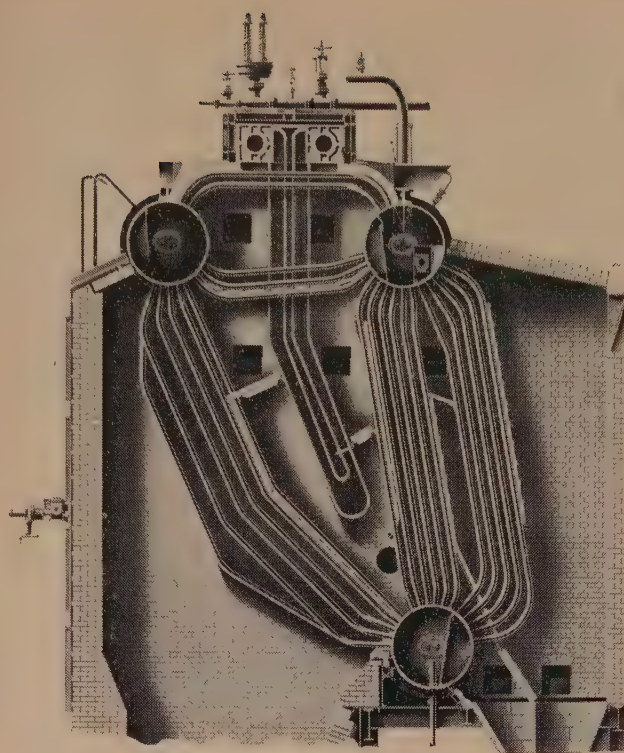
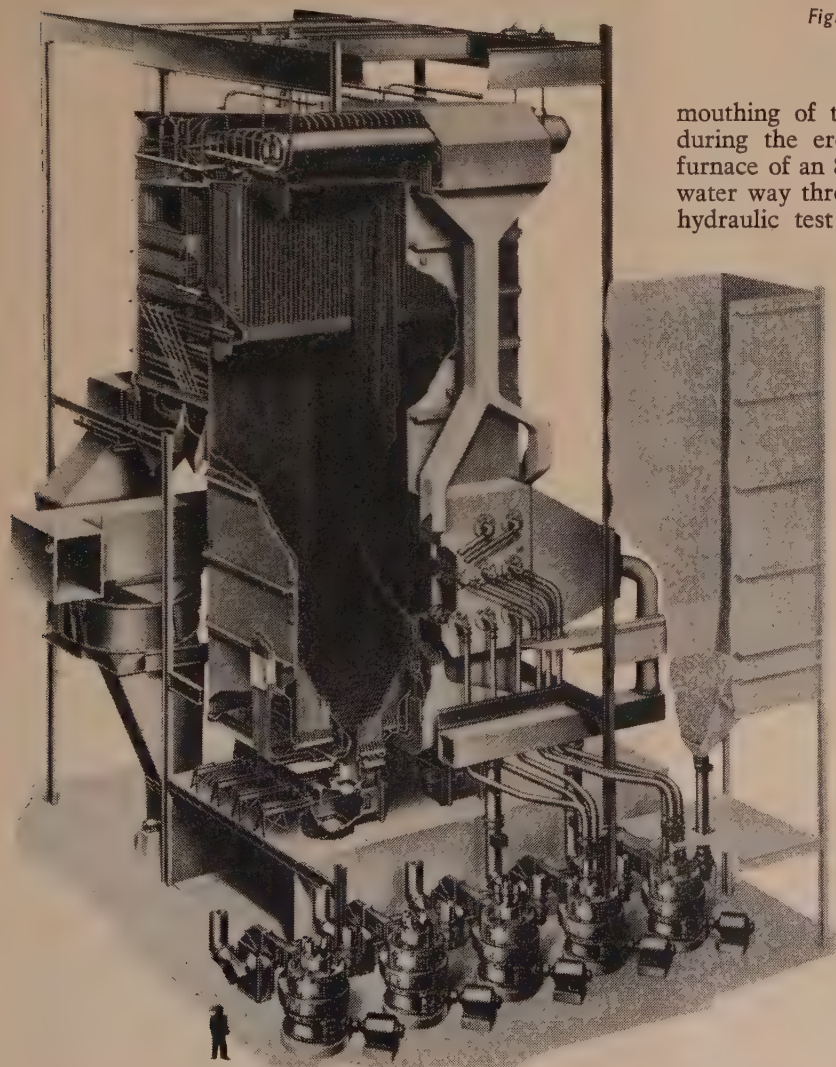


Fig. 2 (above).—Tri-drum bent tube boiler

Fig. 3 (left).—Radiant type boiler



mouth of the tubes. Fig. 5 is a photograph taken during the erection of a bare tube water-cooled twin furnace of an 830 klb/hr radiant boiler. Proving a clear water way through all boiler tubes is important and the hydraulic test of the complete unit is witnessed. All

steam, superheater, economiser, re-heater, feed and blow-down piping, the furnace (Fig. 6 shows the finishing of a "Cyclone" furnace), valves and mountings, the alignment throughout and supports, fittings, etc., are checked and the arrangements critically surveyed to ensure compliance with statutory regulations. Final examination of the completed unit at rest and during commissioning should always be made and the safety valve loadings verified.

Statutory Inspections

The Factories Act stipulates an internal and external examination of the boiler every 14 months. A complete "I and E" examination involves inspection both when cold and under steam, the second part, that is when operating, to be made as soon as possible after the internal or "thorough" inspection. The "thorough" is recognised as of overriding importance. Keen diligence is necessary during the preparation and cleaning and the inspection itself. All drums are opened and the caps of headers removed. The Factory Department allows the inspection authority discretion in some cases to modify preparation of header type

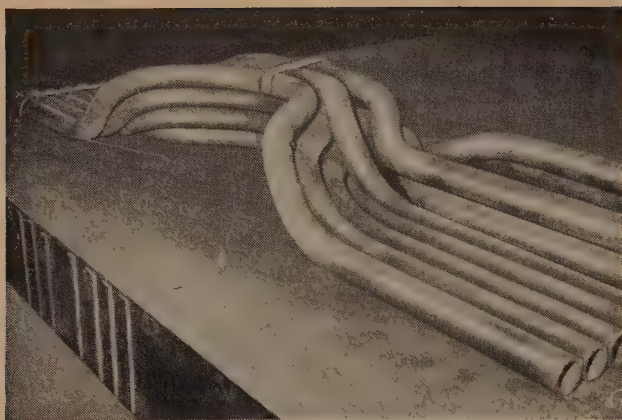


Fig. 4.—Tubes for installation at a burner opening bent in the factory.

boilers so that only a proportion of the tube caps need be removed. As this reduces the time a boiler is out of action, it is a welcome concession. Each case is considered on its merits. Deciding factors are the permanent use of a highly effective water softening plant or the feed being of proved non-sedimentary and non-corrosive water, the inspection of other boiler parts giving good reason to believe that parts not seen are in good condition, that the standard of maintenance and supervision are high and the boiler generally in good order. The owner is expected to keep a record of the caps removed, so that other caps are removed at subsequent inspections and all tubes and headers are examined within a few years.

Sediment can accumulate in bends, and it is necessary for the safe and efficient operation of the boiler to locate such spots. Rolling ball tackle is used to prove a clear water way through bent tubes. Straight tubes are "sighted," that is, looked through, which involves removing the cap at each end of headers. A small low-voltage lamp can be dropped through the tube whilst the surveyor is lying in the bottom drum keeping the inside of the tube under observation. Bellmouthing is closely inspected, especially after renewals or repairs. Tubes occasionally pull out of drums and headers when they are overheated in service. Each tube should project through the drum or header by at least 0.25in, although excessive projection can be very troublesome owing to the tube splitting whilst being bellmouthed. Tubes with diameters of 2 to 4in should have $\frac{5}{32}$ to $\frac{3}{16}$ in allowed for bellmouthing.

Common defects found in tubes are external wasting, often caused by erosion, sludge accumulation as distinct from scale formation, local bulging due to internal scale, greasy deposit or faulty circulation, internal pitting and corrosion, and leakages near expanded joints. A typical bulge is often due to scale, the pocket offering a recess for sediment and thereby aggravating the defect. The cause must be ascertained and remedial steps taken. After careful examination by an experienced surveyor it may be decided not to renew the tube if the local bulge does not exceed 0.25in. Close inspection for leakages at the expanded joints and their accompanying wasting is made. The hydraulic test will usually reveal leakages which otherwise would remain undetected.

The downward bending, "sagging," and upward bending, "hogging," and other distortions of horizontal tubes generally point to overheating, accompanied by abnormal stresses at the joints to the drums or headers, leading to cracking of tubes. When the distortion of 4in tubes exceeds 2in they should be renewed. Smooth external wasting is difficult to detect. If suspected, the tubes are



Fig. 5.—The interior of a bare tube water-cooled twin furnace

gently hammer tested, care being taken not to indent the surfaces, and carefully calipered. Measuring the circumference with a piece of narrow tape and comparing the result against a similar measurement of an unwasted tube is a simple check. The most common cause of smooth wasting is abrasion by fine dust, particularly when firing is by pulverised fuel. It is worth noting that 92 per cent of the 277 boilers of 300 klb/hr and over in service in British power stations in 1958 were fired by pulverised fuel. Headers, being of heavy construction, withstand a fair amount of wasting although water-wall headers can give trouble and require careful inspection for cracking and grooving nearest the furnace.

Owners should retain all removed tubes for cutting up and submission to the surveyor for examination and possibly metallurgical tests by the inspection company. Some large water tube boilers in service have riveted drums, the longitudinal seams invariably being butt jointed with double straps. Serious explosions have occurred owing to cracks developing at the rivet holes. When cracks are suspected during the "thorough" about 10 to 15 per cent of the rivets along the doubtful seam should be removed, the surfaces of the plates and straps wire brushed and made quite clean all round the rivets, and the rivet holes lightly reamed. Wet iron powder is sprayed on the parts and a portable magnetic detector is placed in various angular positions across the rivet holes. The magnetic lines between the poles of the magnet exert little effect on the powder except where the surface continuity is interrupted transversely to the lines and tufting is seen at the cracks which otherwise might be invisible.

It is most important to check the low water alarms because the level can fall rapidly in these quick steaming boilers, where the most frequent cause of overheating is water deficiency. As the drums are mounted in high

positions, remote water gauges are installed in addition to those on the drums. All gauges are closely inspected. The superheaters, particularly those where the tubes are exposed to direct radiation from the furnace, are subject to severe conditions and are constructed of special materials. Meticulous scrutiny by the surveyor is required to locate warping, bulging and wasting. The economiser, especially those of the steaming type for which the tubing was probably welded on site, is closely examined and the reheaters and air preheater are also given detailed attention.

Maintenance Programme Inspections

It is universally recognised that in the interests of safety regular inspection of all pressure parts by competent surveyors is required, but it is not always appreciated that dangerous conditions and breakdowns can rapidly develop if the controls lose their adjustments or the auxiliaries fail. Minimum inspection periods of the boiler are normally governed by statute, but no stipulations are made in respect of the whole plant unit. Logically, the elaborate electro-mechanical automatic control equipment, safeguarding mechanisms and boiler auxiliaries should also receive independent checking.

Steam generators of 300 klb/hr and above could, with advantage, receive one external comprehensive inspection of the complete boiler plant unit per annum made jointly by two engineer surveyors, one mechanical and the other electrical, in addition to the present statutory obligation. The day-to-day maintenance would not be relieved, but settings would be checked, instrumentation confirmed, steam pipes from superheater connection to turbine high-pressure steam chest inspected along with the reheat circuits and their controls. Fans, pumps and couplings

would be examined, air gaps of auxiliary motors measured when practicable and insulation resistance of the various circuits and machines tested when possible. Brush gear and commutators would be inspected and the effectiveness of the earthing proved. Samples of feed water and of oil in transformers connected with the boiler control equipment would be taken. The feed water samples could be analysed by the inspection authority. A high degree of purity of feed water is essential and samples should be taken and analysed by the owner at frequent intervals, whilst the additional security of an independent check is a justifiable expense.

Transformers play a leading part in automatic control when rectifiers feed variable-speed d.c. motors driving the auxiliaries. Constant-speed a.c. motors having variable-speed hydraulic couplings are also used and may be fed from a house transformer. The oil samples from these transformers should be tested annually for moisture, sludge, dielectric strength and acidity.

Solid forged and welded drums should be hydraulically tested at intervals not exceeding 10 years. For working pressures up to 400 p.s.i. the recommended test pressure is 1.5 times the working pressure; and for working pressures over 400 p.s.i. the recommended test pressure is 1.5 times the working pressure plus 100. Some large water tube boilers, mostly of earlier construction, have riveted drums or welded drums with riveted ends. These should be hydraulically tested at intervals not exceeding five years.

Obviously, the tubes are the "weakest link." Tube sections are not expensive to renew, but failures can have serious consequences. In an American power station recently, one tube tore away from an upper drum in a large water tube boiler, and the escaping steam and water extinguished two of the three natural gas burners while unburnt fuel accumulated until the mixture exploded causing \$500,000 worth of damage. Six supporting columns were bent, a 36in wide beam was twisted 5ft out of line and the air preheater was demolished. A smaller event occurring about the same time, resulted from the simple rupture of a 3.75in water-wall tube operating at 600 p.s.i. Circulation irregularities caused the tube to overheat. The repair bill was only \$200, but the production loss whilst the boiler was out of service exceeded \$8,000.

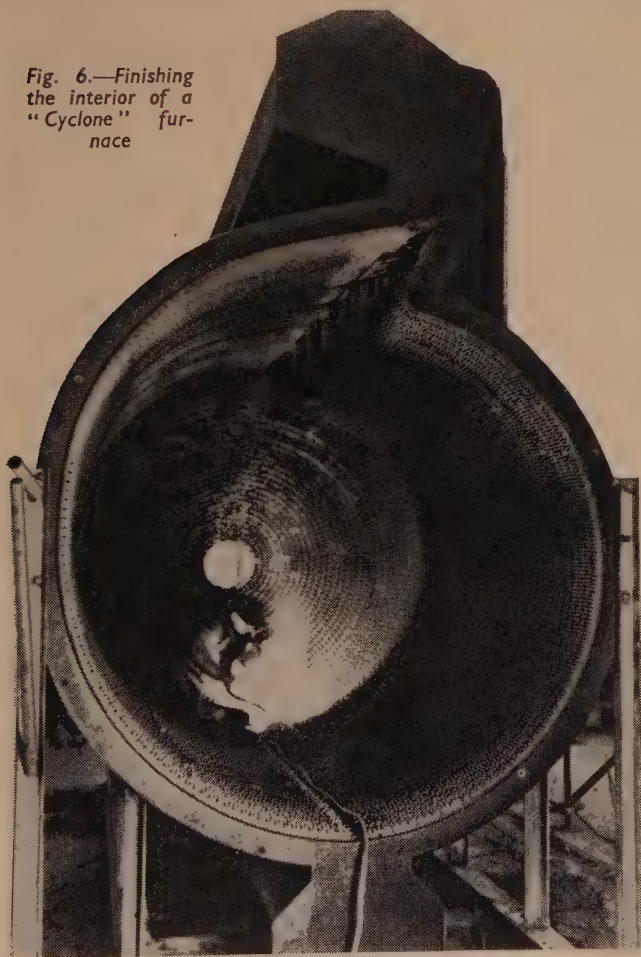
The author wishes to acknowledge the assistance given by Babcock & Wilcox, Ltd., in the preparation of the illustrations.

Planning the Nile Development

THE use of an electronic computer in simulating the behaviour of the Nile during a 48-year period was the basis of a paper, "Planning for the Ultimate Hydraulic Development of the Nile Valley," prepared by Mr. H. A. W. Morrice, irrigation adviser to the Colonial Office, and Mr. W. N. Allan, irrigation consultant to the Sudan, which was read at a recent meeting of the Institution of Civil Engineers.

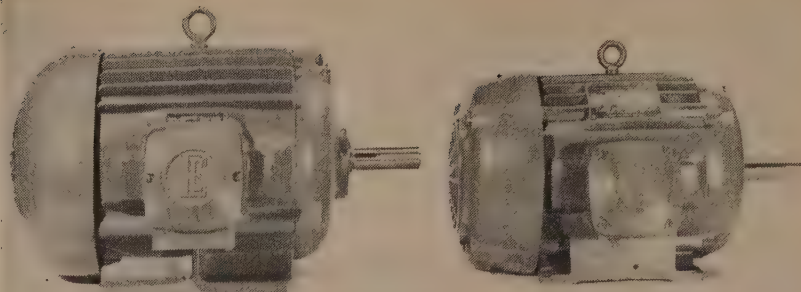
The problem of how the Nile and its tributaries could be developed to the greatest advantage was considered, the main object being to provide as much water for irrigation as possible. A set of equations for the water flow for various conditions was reduced to a form that could be handled by an electronic digital computer. Methods were devised for dealing with transmission and evaporation losses and initial contents of reservoirs. Continuity equations, which express basic natural laws, were contrasted with empirical control equations which were "tailored" to fit the physical facts as closely as possible. The paper was mainly concerned with the methods of computation, and the authors hoped that these procedures would be of value to other engineers faced with similar problems.

Fig. 6.—Finishing the interior of a "Cyclone" furnace



ENCLOSED FAN-COOLED MOTORS

Side view of the English Electric 7½ h.p. type "D" motor on the right compared with a type "B" motor of the same rating



A RANGE of totally enclosed fan-cooled motors which are smaller, lighter and cheaper than existing motors of the same type is announced by the English Electric Co., Ltd., Marconi House, Strand, London, W.C.2. The dimensions of the new motor are exactly the same as the "C" type ventilated motor to British Standard 2960 and the two types are, therefore, interchangeable. Known as type "D," they have outputs up to 100 per cent greater than existing motors of the same size, type "B." For example, a 40 h.p. "D" type motor is now manufactured in the same frame size as the previous 20 h.p. "B" type. This has been achieved by allowing a temperature rise of 65°C above 40°C instead of the existing 55°C, obtained by using Class "E" insulation instead of Class "A."

These motors are designed for wide industrial application, particularly where there is dust and dirt in the atmosphere. Special versions, having internal and external anti-corrosion treatment, will be produced for the chemical and gas industries. An all-cast-iron exterior with finger-proof cowls and a plastic (polyester) non-corrosive external fan is incorporated, with a terminal box of weatherproof construction with four screw fixing bolts, drain holes with easily detachable plastic plugs, provision for an earthing terminal and a rating plate with full motor details, including bearing sizes and grade of grease.

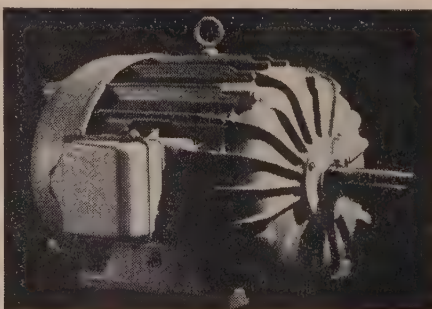
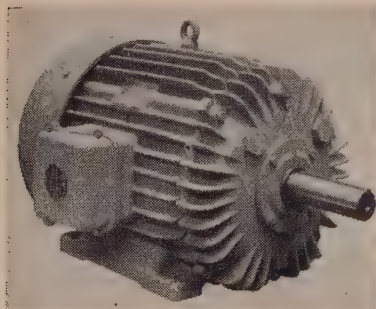
The range of outputs is covered by twelve frame sizes, with 2-pole machines from 1½ to 30 h.p., 4-pole from 1 to 40 h.p., 6-pole from ½ to 25 h.p. and 8-pole from ½ to 20 h.p. The motors can be wound for operation on any 2- or 3-phase supply up to 650 V at 50 and 60 c/s and they are also available for any specific frequency such as a 25 or 40 c/s supply. They will give an average starting torque of approximately 200 per cent full load torque with an average starting current of 700 per cent full load current when started direct-on-line. High torque motors will be available where special starting characteristics are required.

Production of foot-mounted motors up to 10 h.p. has already started. Other outputs and mountings—foot, flange, skirt, foot and flange, pad and airstream rated—will follow. Type "B" motors will still be manufactured.

New A.E.I. Design

An addition to their range of industrial motors is also announced by the Motor and Control Gear Division of Associated Electrical Industries, Ltd., at Rugby. The new

The new A.E.I. Type KN-D motor and, on the right, a Crompton Parkinson Series 5 motor



motor is designated Type KN-D and is of the totally enclosed fan-cooled squirrel-cage induction type, with ribbed frame and endshields. Class "E" insulation is used, permitting a maximum temperature rise of 65°C. The machine complies electrically with B.S. 2613 : 1957 and its dimensions are such that it is completely interchangeable, rating for rating, with the ventilated (A.E.I. Type KN-C) British Standard dimension motor built in accordance with B.S. 2960 : 1958.

The use of the improved insulation makes it possible to offer a motor of smaller dimensions at a lower price than the earlier Class "A" insulated 55°C rise British Standard dimension machine which it replaces. The new motor is immediately available in sizes up to 7½ h.p. but at a later date the range will be extended to 40 h.p. at 1,500 r.p.m.

Crompton-Parkinson Series 5 Motors

The development of totally-enclosed, fan-cooled, industrial a.c. motors with Class "E" insulation, which develop up to twice the power of previous standard totally-enclosed machines of equivalent frame size, is also announced by Crompton Parkinson, Ltd., Crompton House, Aldwych, London, W.C.2. These motors, designated Series 5 T.E.F.C., are substantially smaller and lighter, and on average 9½ per cent lower in cost, than the machines they supersede. They conform to B.S. 2613 : 1957 with Class "E" insulation and have fixing dimensions the same as Series 5 ventilated motors to B.S. 2960 : 1958.

Throughout the range, motors of equal rating are interchangeable, having identical fixing dimensions. All the motors can now be supplied with fixing dimensions to the American N.E.M.A. specification and can, therefore, be made interchangeable with American machines of the same power. The dimensions adopted are in accordance with the latest recommendations of the International Electrotechnical Commission.

The fan used promotes a high velocity air stream which remains in close contact with the motor carcass over its whole length. Rapid transfer of heat through the motor is promoted by an interference fit of the stator stamping packs in the housings, enabling the usual longitudinal cooling fins on the outside of the motor to be dispensed with in the smaller motors in the range. By varying the rotor design, different starting characteristics to suit special requirements can be provided, including high torque rotors for applications involving a large amount of static friction, and high slip rotors for flywheel drive applications. The range is available on a normal dispatch basis in ratings from 1 to 7½ h.p. at 1,400 r.p.m., and motors from 10 to 40 h.p. at 1,400 r.p.m. will be available early in the spring.

The introduction of a range of Class "E" insulated ventilated motors was first announced by the company three years ago. While T.E.F.C. motors have in the past been larger and heavier than the equivalent ventilated motors, the new range has the same frame size at a given rating as the latest ventilated motors.

INDUSTRY AND THE HOUSE

Debate on the E.F.T.A. Convention

By AUSTEN ALBU, M.P., B.Sc., A.M.I.Mech.E., M.I.P.E.

PROBABLY the most important business dealt with by Parliament in the week before the Christmas recess was the Convention of the European Free Trade Association. And yet it was no great occasion. The Chancellor of the Exchequer, with more than his usual modesty, recommended the Convention tepidly to a thin House. It covers seven countries which, as was later said in debate, are on the periphery of European trade and to which Britain exported last year £319 million worth of goods, and from which she received £366 million worth of imports, mainly food and wood products.

Proposed Tariff Reductions

Under the terms of the Convention the first tariff reduction of 20 per cent is to take place on 1st July, 1960, and all tariffs on industrial goods between the participating countries are to be eliminated at the latest by January, 1970. By that time also all quantitative restrictions are to be removed. Because the member countries will not have a common tariff in relation to countries outside the area, elaborate rules to identify the origin of products have been worked out and are embodied in a Blue Book. These provisions do not apply to agricultural goods or fish. Countries will be free to take any action they consider necessary for the protection of their essential security interests and their balance of payments and, in certain circumstances, to safeguard a particularly affected sector of industry.

As Mr. Amory pointed out, the institutional arrangements have been kept at a very "anti-Parkinson" level. There is a Council in which each member will have one vote. Unanimous decisions will be necessary in the more important cases; but majority voting will be the rule in many others. Mr. Roy Jenkins, for the Opposition, pointing out that the members of the rival European Economic Community had rejected our proposals for a Free Trade Area because they wanted a closer political connection, criticised the lack of a parliamentary assembly and any advisory council in which the trade unions could be represented, as in the Community.

Mr. Amory claimed that, while the population of the E.F.T.A. (the "Seven") is only about 90 million compared with the 160 million of the Community (the "Six"), its national income is two-thirds as big and its foreign trade about three-quarters. He did not look for any dramatic increase in our exports, but the markets in the member countries were rich and, therefore, selective. He said that about 70 per cent of the trade associations approached by the Federation of British Industries positively favoured the proposals and more than half the rest were prepared to accept them. He re-affirmed the Government's intention to renew their efforts for a fruitful negotiation with the Community, bearing in mind the interests of the Commonwealth and our other trading partners.

Mr. Jenkins, while not opposing the principle of the Convention, was pretty scathing about its value. Of the 90 million population of members of the Association we ourselves contributed 50 million. While the national

income per head of the Seven was higher than that of the Six, it was not rising as fast. Industrial production was rising faster in the Six, especially in Germany, France and Italy, than in the countries of the Seven. He said that the value of the Seven would be judged by the extent to which it facilitated an arrangement between the Six and the Seven. It was important for British industry to know early whether the Government viewed the Seven as something which should stand on its own account or as something which would lead at an early stage to entry into the Six. He welcomed the maintenance of the competitive position of our industry, but thought it undesirable that it should be left in the position where it did not know whether it was being asked to adjust itself to a favoured position in the Scandinavian market or whether, in a short time, it would have to return to a position in which Germany would be equally favoured in Scandinavia, while we were correspondingly favoured by Germany and the other members of the Community.

Mr. Jenkins made the point, which was strongly supported by other members, notably Mr. Peter Thorneycroft and Mr. John Hynd, that the Government were under-estimating the political force of the movement in Europe towards unity. He felt that while Europe had gone ahead, we were finding ourselves increasingly on the side lines, both economically and politically. He thought the difficulties of the Commonwealth associated with a fresh approach were not insuperable.

Effect on Other Countries

The strongest opposition to the Convention came from Mr. R. H. Turton on the Government benches. His chief criticism was that our preoccupations in Europe were being seriously misunderstood in Asia and Africa whose peoples were suspicious that Europe was ganging up against them. He felt that we had neglected opportunities for trade with the Commonwealth and underdeveloped countries throughout the world. Last year Europe took 12 per cent less in primary products from the semi-industrialised countries outside Europe than in the previous year.

Mr. Thorneycroft, speaking with all the authority of one who had been intimately involved in these negotiations, wanted the Government to start again to try to get a multilateral European arrangement for the removal of all internal tariffs, even if this meant some sacrifice of our future freedom of action. Mr. Harvey Rhodes, himself a progressive woollen textile manufacturer, was worried at the speed of technological advance in the Common Market countries. He said that at the Milan Fair, apart from one or two outstanding exhibits, the rest of the British exhibits of textile machines were a laughing stock.

Mr. Harold Wilson mainly contented himself with asking the Government a lot of questions; but he finished up more of a Commonwealth supporter than Mr. Jenkins and suggested a Free Trade Area for the Commonwealth. The President of the Board of Trade was at pains to explain that we could not be part of a federal Europe

but that we wanted a multilateral European free trade organisation. He defended our existing Commonwealth preferential system which was still responsible for nearly half our trade and was the basis of our political relations with the Commonwealth. We should not tie our hands, he said, in dealing with 86 per cent of our products throughout the world because of an agreement which would cover only 14 per cent of the market for our products.

What is most interesting about this debate is the

growing division, cutting across party lines, between those who believe in a closer association with Europe, and those, including the Government, who still believe that our relations with the Commonwealth give us a special economic advantage which enables us to remain outside the tariff-free market which is growing in Europe. The actions of some of our manufacturers in planning to build factories on the Continent may be an indication that they think it necessary at least to hedge on this particular issue.

HEAVY-OIL ENGINE PERFORMANCE

REPORT ON OPERATION IN POWER STATIONS AND PUMPING PLANTS

THE annual report of the Diesel Engineers' and Users' Association on heavy-oil engine working costs and performance, which relates to 1958-59, was presented to members on 17th December. Its 23 pages include leading particulars of engines, running costs per kWh generated for 41 electric power stations in Britain and 34 abroad, and running costs for 16 pumping stations in Britain.

In an introduction Mr. W. A. Parker refers to a diminution in the number of returns received owing to the purchase of electricity from national grids. In Queensland, Australia, where oil fuel cost £46/ton last year, diesels have been superseded by central steam and hydro plant. In some stations listed, where the engines are used on peak loads and have annual demand factors of less than 10 per cent, the gross costs are stated to be unrealistic because of the high wages content, but in other respects the figures are generally comparable. In many such stations loads carried are in excess of engine ratings for their short running periods.

In addition to the usual constructive comments provided by the engineers responsible for the operation of these internal combustion engine installations, particulars are given in some detail of an experimental conversion of an English Electric 6Q Fullagar engine to furnace fuel oil. The expenditure on ancillary equipment amounted to £2,400. Preheating the oil by water bled from the station system and by electricity to maintain a temperature of 85°F contributed largely to the overall efficiency. The engine was started on gas oil and changed over immediately to f.f.o. after reaching the required viscosity. It was changed back for 30 minutes before shutting down to flush the pumps and nozzles.

During six months of operation on f.f.o. 1,630,000 kWh was generated in 2,000 hours for a consumption of 0.585 lb/kWh of fuel with an average specific gravity at 60°F of 0.944 and a gross calorific value of 18,340 B.Th.U./lb. Fuel cost amounted to £4,859 plus £149 for 20,500 kWh valued at 1.75d for heating and centrifuging the oil. The equivalent cost using gas oil with an average specific gravity of 0.835, a gross calorific value of 19,500 B.Th.U./lb and a consumption of 0.550 lb/kWh generated was £6,346, giving a saving of £1,338 in the six months—equivalent to 55 per cent of the capital outlay.

The only observable alteration in running on change of fuel was a rise in load of 50 kW that necessitated readjustment of the governor setting. This was due to an increase in the pressure at the fuel pump and by-pass sleeves from 5 to 30 lb/sq in at 160°F to ensure quick

circulation in the fuel rail so as to maintain even temperatures, but any loss was retrieved by reheat before circulation. Initially, too much wax was removed by the centrifuges, but through raising the temperature to 180°F the time between cleaning was doubled and wax extraction was minimised. About 90 per cent of the wax content of f.f.o. was estimated to be injected. This was not consumed in combustion but condensed on the cooler parts of the liner and exhaust ports, leaving carbon and ash residues.

More frequent decoking seemed to be required than with gas oil and the bowls in the centrifuges required cleaning after four to five hours' continuous operation. Hence the capacities of service tanks and centrifuges should be approximately twice those for normal fuel requirements. For an additional outlay of £1,000 it is estimated that all the remaining six sets in the 4,300 kW station could be converted to show a net annual saving of £5,500 in fuel costs.

Science Graduate Courses

DETAILS of graduate courses in pure and applied science covering such subjects as mathematical physics, reactor physics, engineering production and thermodynamics are given in a booklet published by Birmingham University. Most courses are intended for honours graduates of universities and normally lead to the degree of M.Sc. or the Diploma in Graduate Studies after 12 months' full-time study. The course generally commences in October, has a principal written examination in the following June and requires the presentation of a report on experimental work or an individual study by the following October. The M.Sc. is normally awarded only to those holding the B.Sc. degree of an approved university but in some cases candidates with comparable qualifications may be considered eligible. For non-graduates not so accepted, the award is the Diploma in Graduate Studies.

A new course on the theory of electrical machinery comprises five sections: mathematics, the electrical properties of materials, automatic control systems and two sections dealing with electrical machines. The first of these is concerned with the application of mathematical techniques such as matrix analysis to rotating machines, and the second is concerned with electromagnetic and thermal problems in the design of large machines. The student's experimental investigation or study will be related to such topics as the distribution of electromagnetic fields in machines and the characteristics of machines for automatic control systems. Further particulars may be obtained from the Registrar, the University, Birmingham, 15.

EARTHING

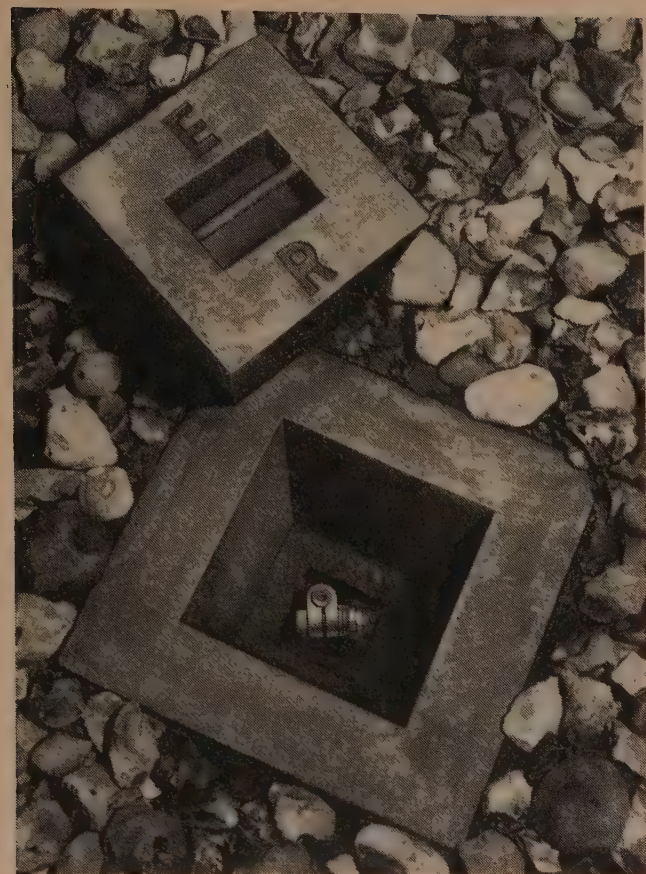
PRACTICE

INSTALLATIONS AND ELECTRODES

By J. MELLANBY, M.A., A.M.I.E.E.

A discussion of the general types of earthing installations, including protective multiple earthing, for protection against shock, fire and lightning is followed by a description of various forms of earth electrodes. Brief mention is also made of the use of earth leakage circuit-breakers

Inspection pit showing connection to the rod-type electrode (British Insulated Callender's Cables, Ltd.)



ACCORDING to the definition given in the I.E.E. Wiring Regulations, "earthed" means "effectually connected to the general mass of earth" which is sometimes described as being at zero potential. Taken as a whole, the earth's crust is not a particularly good conductor. Average values for surface soils in temperate climatic areas are usually in the 2,000-6,000 ohms/cm³ range, the decomposed granite known as laterite commonly found in the tropics approaches 30,000 ohms/cm³ while rock and dry desert sand may give even higher figures. At the other end of the scale, much lower values are encountered near the sea, especially where the electrodes can be made to enter strata permanently saturated by salt water.

Cable Networks

With the almost universal use of lead sheathed and armoured cable for distribution in urban areas, a metallic return path of low impedance is available for fault currents between consumers' premises and the substation and, in general, fuses will also give protection against earth faults. This will occur whatever the nature of the actual earth connection itself, provided that the connection between the equipment being protected on the consumer's premises and the cable sheath is sound. On a normal network, the cable sheathing and armouring will be connected to earth in one or more of the following ways:—(1) Directly to the main substation electrode; (2) wherever sheathing, armour or joint boxes are in contact with earth throughout the system; and (3) other metal, also in contact with earth, which may be either deliberately or fortuitously bonded to the cable sheath, i.e. water pipes, structural steel-work, etc.

One important fact to remember is that the neutral conductor will be directly connected to earth only at the

substation, and all cables, whether supply authorities' mains or consumers' wiring, must normally be insulated. There are, however, circumstances in which the neutral may be earthed at more than one point, these being:—(1) If the system known as protective multiple earthing (p.m.e.) is adopted by the authority; (2) if earthed concentric wiring is used on consumers' premises; and (3) wherever electrode boilers are installed in accordance with I.E.E. Rule 322 which requires the neutral to be connected to the earthed shell of every boiler. It is interesting to note that, in Britain, the special consent both of the Minister of Fuel and Power and of the Postmaster General is required for the first and second exceptions, while unlimited multiple earthing due to electrode boilers need not be notified to these authorities.

Earthed concentric systems enjoyed some popularity during the 1880's and the introduction of Stannos copper sheathed cable in 1907 resulted in a revival of interest. The same arguments are being put forward again today in connection with mineral insulated, copper sheathed cables. It is felt, however, that the advantages claimed of economy and low volt drop may be gained at the expense of reduced safety; there are quite a number of circumstances in which the exposed conductor could become alive under fault conditions, while a more conventional two-wire system would be safer. P.m.e. is applied to distribution systems normally using overhead lines. At each service point the frames of the consumer's apparatus and the incoming neutral are connected to an earth electrode, while additional earths may also be joined at any pole if considered necessary. From a number of recent publications on this subject, it would appear that even its protagonists consider that it should be restricted to areas where reasonably low values of earth resistance

can be obtained, not exceeding 10 ohms at each service point.

"Stray" currents, finding their way through the earth, can cause quite a lot of trouble. It is because of their possible effects on communications circuits that any system of multiple earthing requires the consent of the Postmaster General, while electrolytic corrosion was often experienced in the neighbourhood of d.c. tramways. It would appear, therefore, that there is much to be said for insulating all current-carrying conductors and restricting the number of earth connections to one per network.

Lightning

Very high transient values of voltage and current may be expected while lightning surges are being led away to earth so that every possible way of reducing the impedance



Screwdown test clamp
for $\frac{3}{8}$ in and 1 in tape
(W. J. Furse & Co., Ltd.)

of the earth paths should be exploited. While it is obvious that the lowest impedance will be achieved by some system of multiple electrodes, the actual design of this is usually purely empirical, though experience can be a useful guide. For example, the Phoenix Fire Office rules state:—

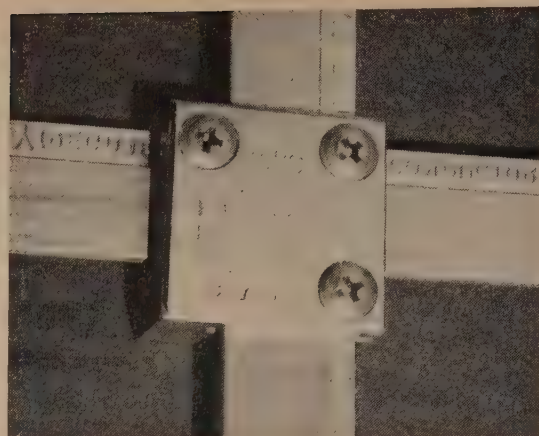
Rule 5. Earth connections, and number. The earth connection should be made either by means of a copper plate buried in damp earth, or by means of the tubular earth system, or by connection to the water mains. The number of connections should be in proportion to the ground area of the building, and there are few structures where less than two are necessary. . . . Church spires, high towers, factory chimneys having two down conductors should have two earths which may be interconnected.

Earth Resistance

As a result of the growing realisation of the importance of the efficiency or otherwise of earth electrodes, simple means of resistance measurement were developed, and these have been included in the I.E.E. Regulations since the 11th Edition. Unfortunately, this seems to have given the impression in some quarters that the values so obtained can be treated as fundamental constants, whereas in fact they vary from day to day and even from hour to hour with the amount of moisture in the ground, and in other less obvious ways. It would seem that the only safe way to assess any particular earth electrode or system is to take as large a number of readings as possible over the longest convenient time and to use the highest figure obtained.

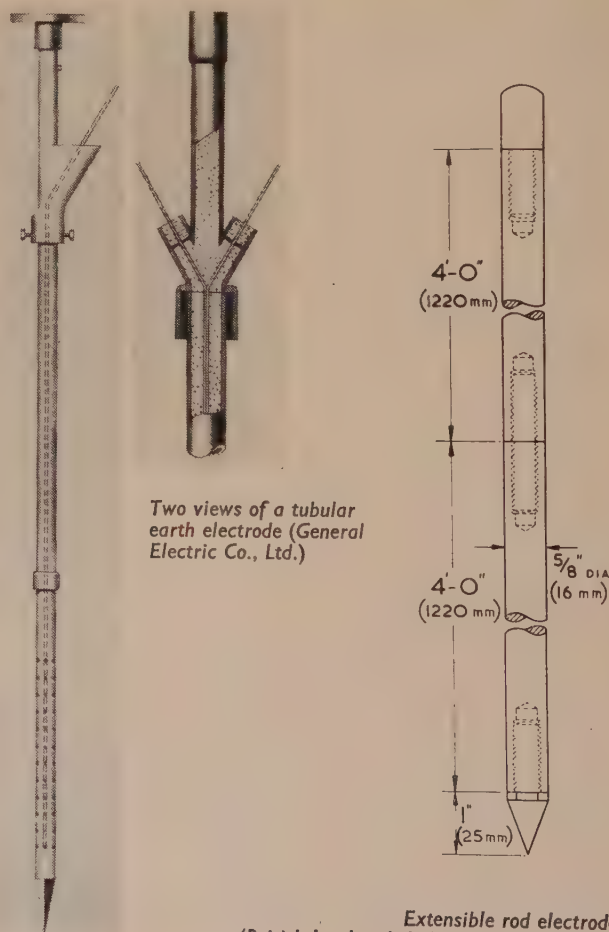
Forms of Earth Electrodes

The design of lightning conductors, together with their associated fittings and earths, is largely empirical—adequate mechanical strength and the provision of sufficient metal to combat corrosion being important considerations. The usual sizes of conductor tapes are:— $\frac{3}{8}$ in by $\frac{1}{8}$ in (0.094 sq in) and 1 in by $\frac{1}{8}$ in (0.125 sq in), and some of the accessories used in connection with these are illustrated. An important fitting is the substantial test clamp, whereby the conductor may be temporarily disconnected for resistance measurement, etc.



Portaway earthing system crosswise clamp

Copper plates, 2ft square and upwards, are commonly used as electrodes, though the rising cost of metal has resulted in the development of the lattice type. To increase the area of contact between the plate and the surrounding ground, it was often recommended that a layer of charcoal be interposed. Unfortunately, wood charcoal is not always conveniently available, and coke is sometimes used instead. This material often has a high sulphur content, which can lead to heavy corrosion and even complete destruction of the copper. The use of hygroscopic salts like calcium chloride to keep the soil in a moist condition may also lead to corrosion. An ingenious method of keeping the earth electrode damp is



Two views of a tubular
earth electrode (General
Electric Co., Ltd.)

Extensible rod electrode
(British Insulated Callender's Cables, Ltd.)

Portaway Dyrod earth electrode. The clamp in the centre of the rod is for "driving-in"

the tubular earth, invented by Killingworth Hedges last century, and still manufactured and installed today. As can be seen from the illustration of the tubular earth electrode (p. 16), rainwater from the building is made to pass down a perforated pipe which contains the down lead, the space between being packed with charcoal. When the use of rainwater is impracticable, other means of watering may be arranged.

The commonest form of electrode used today is the copper rod, which, when fitted with a driving spike, can be driven into the ground to the required depth without the need for excavation. They are normally made in a range of diameters from $\frac{1}{2}$ in to 1 in and single rods can be of any length up to about 12 ft. It is, however, often more convenient to purchase them in 4 ft sections, fitted with screwed couplings, the lowest one having a hardened tip and the last one a terminal for the lead. If the earth resistance obtained is measured during installation, the number and lengths of the rods can be chosen to give the required value. While most earth rods are of circular section, it is believed that increased surface area, leading to better contact with the ground, can be achieved with other shapes. Thus one maker uses a "D" section, while rods of a "cog wheel" profile, giving up to 100 per cent increase in area, are also available in small sizes, primarily for radio sets. Galvanised steel is sometimes used to save the high price of copper, but this is likely to have a short life in many soils. An economical design, now in production, makes use of copper-coated steel.

While lightning conductor material has often been used to earth substations and heavy electrical equipment, more specialised designs are now available for this purpose. In one system there are seven sizes of conductor, rising from 0.015 sq in to 0.5 sq in, so that the optimum value can be chosen for each particular installation, bearing in mind conductor area and possible level of fault current. A thin, continuous tab is extruded with the conductor and provides, at intervals, permanent information as to the conductor size with arrows pointing in the direction of "earth." Fixings and connections are effected by an ingenious series of clamps—no conductor material is lost through having to make holes in the tape itself, only the tab being punched for the locating screws.

Earth Leakage Circuit-Breakers

While the use of these devices is now widespread, and in fact they are required by the I.E.E. Regulations wherever direct earthing of sufficiently low impedance is not attainable, difficulties sometimes arise. These have provided the subject for much recent literature, and the situation may be summed up as follows:—

(1) Where the apparatus being protected is connected to earth by a number of parallel paths, only one of which passes through the trip coil of the (voltage operated) e.l.c.b., this will still give effective protection against shock, though leakage currents of large enough value to constitute a fire risk may flow.

(2) While the above effect could be avoided by the use of the core balance type of e.l.c.b., this has the following disadvantages:—(a) Absence of shock protection in situations with high earth resistances; (b) high cost, unacceptable in domestic installations, especially if both core balance and voltage operation are called for.

(3) While effective protection against both shock and leakage currents can be given by the voltage operated type of e.l.c.b., if the earth lead is insulated and parallel earth paths avoided (as, for example, by using a length of insulating piping in the water supply to a heater), fears are sometimes expressed that the protection is entirely dependent on the circuit-breaker, and that if this should fail to operate, there is no "back-up" protection in the form of normal earthing. Even if the total earth resistance was so high that the fuse would not blow, some authorities think that the reduction in voltage would have some value.

The Dilemma

It will be seen from the above that complete protection against all the three hazards of (a) surges due to lightning, (b) shocks from faulty apparatus and (c) fire risk due to undetected leakage currents, demands conditions which may be incompatible. Thus, for (a) all metal should be bonded together and earthed at as many places as possible, (b) is most effectively prevented by using voltage operated e.l.c.b.'s, each with its own individual electrode and by carefully avoiding parallel earth paths, (c) can be effectively guarded against by means of the core balance type of protection, but this does not give adequate protection against shock in regions of high earth resistance, while the combination of core balance and voltage operation is likely to be excluded from many installations, especially domestic ones, on account of its cost.

The use of p.m.e. is not a satisfactory solution, especially where earth resistances are high, as it may transfer unwanted voltages, due either to leakage or to lightning, from one consumer to another, and the presence of parallel conducting paths through water pipes and other metal may mean that high-resistance joints or even breaks in the neutral may remain undetected.

South African Atomic Research

DR. A. J. A. ROUX, director of the South African Atomic Energy Board's £4 million research and development programme, said in Johannesburg recently that the objects of the programme were to ensure that the country derived the maximum benefit from the fact that it was one of the three largest producers of uranium in the world; to enable the Union to make a contribution to the vast and important field of atomic research and development; and to assist the young and vigorous South African industry to orientate itself to the new technology which was associated with atomic power. Uranium had come to play a very important part in the Union's economy. In 1958 South Africa had exported uranium oxide to the value of about £53 million. The world's civil requirements by 1970 had been put at between 40,000 and 100,000 tons of uranium oxide a year, and the indications were that the supply would then exceed the demand. It was necessary therefore to improve the methods of mining and extracting uranium in order to strengthen the Union's position in a competitive market.

Dr. Roux said that thorium was the only alternative source of nuclear fuel, and South Africa—as probably the largest producer of thorium—should prepare itself for the time when a demand for this material arose. The Union also had an interest in the production of heavy water. In this respect the country was favoured by two very important factors—the availability of cheap power and, at Sasol, the largest single source of synthetic hydrogen in the world.



Materials for the Electrical Industry

FACTORS OPERATING DURING THE PAST YEAR

This is the customary annual review prepared for us by the Metal Information Bureau, Ltd. It traces the various events which influenced the volume of supply and the prices of materials during 1959.

COPPER.—The story of copper in 1959 is really the story of a strike. The stoppage of production at all the main American primary producers which began last August—and has not been fully settled at the time of writing (though the end is probably now not far off)—has been outstanding in several ways. It was probably the most publicised strike in the history of the industry and the threat of it was already affecting the American copper situation when 1959 began. United States consumers and, to a much smaller extent, users in other countries, decided this time that they would not be caught short of supplies and began building up reserves of the metal and its semi-finished products for months before the deadline of the old wages agreement on 30th June. In this they were helped by the fact that there was a substantial surplus of production over anticipated industrial needs, amounting possibly to as much as 350,000 tons a year, although the consumption trend was upward.

However, the stock building process in the early part of the year sufficed to raise prices quite sharply from an average of about £230 in January to an average of £248 10s in March with an actual peak of £257 15s for cash metal. By the end of March, buying slowed down and the high level of production began to exercise its influence on prices which fell away fairly steadily to an average of only about £220 a ton in July and a bottom price of £209 10s.

The American strike was later accentuated by a stoppage during most of October at the Braden mine in Chile. As a result, the general trend of prices in the latter part of the year was upwards, particularly for spot, which averaged slightly over £250 in November. Consequently, the average level of prices over the whole year was substantially above that of 1958. The strikes are estimated to have resulted in a loss of production of the order of 250,000 tons.

When prices eased rather markedly in the second quarter and the supply position, in the event of there being no strike in America, began to look dangerously top-heavy, some American producers and the Rhodesian Selection Trust Group in Africa curtailed output.

Although, in general, world trade has been on the up-grade during the past year, the copper wire industry in the United Kingdom has had a bad time. With Russia able this year to import raw copper freely, the big Soviet orders for wire which had been a feature of the previous two or three years disappeared and this coincided with a period of depressed business and acute competition in the British cable industry. As a result, United Kingdom copper wire production in the first ten months of 1959 was only 183,887 tons, compared with 241,239 tons in the corresponding period of 1958, although in the closing months of the year there was a welcome upward trend in the monthly rate of output. Another aspect of this

situation has been some important moves towards vertical integration of rod rolling and cable making concerns, as well as horizontal mergers.

Apart from this heavy setback in wire, however, output of other unalloyed copper products has been quite well maintained, while semi-finished products of brass and other copper alloys showed some improvement, particularly in the case of rods, bars and sections and sheet, strip and plate. This was due in part to the demand for such products that developed from the United States after the strikes there had been in operation for some time; this demand was also extended to Continental fabricators.

United States producers' stocks of refined copper which, at the end of July, stood at 103,432 short tons had been whittled down to 74,642 tons at the end of November and those of producers in the free world outside America similarly fell from 286,736 tons at the end of July to 235,859 tons at the end of November. Assuming that the American strikes are ended in the near future, it will, nevertheless, probably be some months before depleted stocks are rebuilt to a normal level and this may serve to support the copper market for a time. Looking further ahead, however, there is a fair amount of new productive capacity coming into operation in 1960, notably the Toquepala project in Peru (with an annual output of 120,000 tons), and if copper producers the world over should enjoy a strike-free year substantial excess of production over estimated requirements is in prospect even though the indications are that 1960 will be a year of high industrial activity in many parts of the world, with a correspondingly large copper consumption.

A number of the leading producers are anxious for more stable price conditions in the copper industry and this view is also shared by many consumers. Talks between the producers and the consumers of possible alternatives to the London Metal Exchange as a pricing basis for long-term contracts have continued during the year, but agreement has not yet been found possible. Consumers in some Continental countries seemed ready to accept the producers' latest proposals, but in the United Kingdom and Germany considerable opposition has been voiced.

TIN.—The International Tin Agreement moved into smoother waters during 1959. World consumption on the whole has shown a satisfactory upward trend and tin prices in the early part of the year rose fairly sharply.

The consumption picture would probably have been even better than it was but for the very long drawn-out steel strike in the United States which had a serious effect on tinplate production there. The International Tin Council raised export quotas gradually from 20,000 tons for the final quarter of 1958 to 30,000 tons in October-December, 1959, with the January-March, 1960, figure announced as 36,000 tons—or about 95 per cent of the level prevailing before curtailment had to be instituted. All the Special Fund stocks of tin were liquidated by the Buffer Stock quite early in 1959 and the main Buffer Stock holdings have been reduced from upwards of 23,000 tons to around 10,000 tons. In addition to this, the Buffer Stock disposed of 2,500 tons of British Government

stocks and is to sell the last 2,417 tons of such stocks in the coming year. Exports of tin from Russia this year have been less than the 13,500 tons maximum promised by the Soviet Union.

Meanwhile, Bolivia, Thailand and the Belgian Congo disposed of well over 6,000 tons from their stocks under barter transactions with the Commodity Credit Corporation in the United States.

LEAD AND ZINC.—Lead and zinc are, of course, widely different in their properties and uses; even in the electrical industry, the two metals are used in widely varying branches. This has been emphasised in 1959 by the different fortunes of the two metals on the consumption side. Lead, competitively attacked in the cable industry by aluminium and plastics, has been in constant over-supply, while zinc, which, largely through die castings, has a substantial stake in the booming motor car industry, has been much healthier. However, both metals have been very much influenced throughout the year by similar factors affecting the supply side, and for this reason they are considered together here.

The year opened inauspiciously enough with fears of increased offerings of both metals in Europe, as a result of the United States import quotas, in force since the previous October. However, as there was little prospect of these being removed, thought was turned at this stage to some form of international control of supplies analogous to what was being done by the International Tin Agreement. A third meeting under United Nations auspices of the major countries was called in April and at its conclusion announced voluntary reductions of production and exports of both lead and zinc and their ores by producers in a number of countries. These were designed to reduce an estimated surplus of lead supplies in 1959 from 150,000 tons to an annual rate of 59,000 tons in the second half of the year and a similar reduction in the case of zinc from an estimated surplus production of 120,000 tons to an annual rate of only 16,000 tons.

Apart from the United States, where matters have been bedevilled by the steel strike (which especially damaged the use of zinc in galvanising and where attempts at

political action to secure further protection for the domestic industry have remained a feature), the market has been concerned with studying the development of the effects of these restrictions on supplies. Generally speaking, they have been fully successful in the case of zinc (where consumption has recovered quite strongly outside the United States), but markedly less so in the case of lead. Producers' stocks of lead have actually increased during the year, except in America where reserves dwindled owing to the biggest producer being idle for several months owing to strikes.

In zinc the progressive reduction in the volume of concentrates coming on to the market led first to an intensified demand for ore by the smelters and later to some stringency in spot metal in Europe, where all the main zinc-using industries were enjoying a good level of demand. Prices rose at one time very close to £100 per ton, although maintaining a wide backwardation. To prevent serious trouble to users here, the United Kingdom Government released a further 3,000 tons of prompt metal from its strategic stocks in November. Meanwhile, the strength of demand from the die casting sector of the industry had led to a rise in the premium for minimum 99.99 per cent metal.

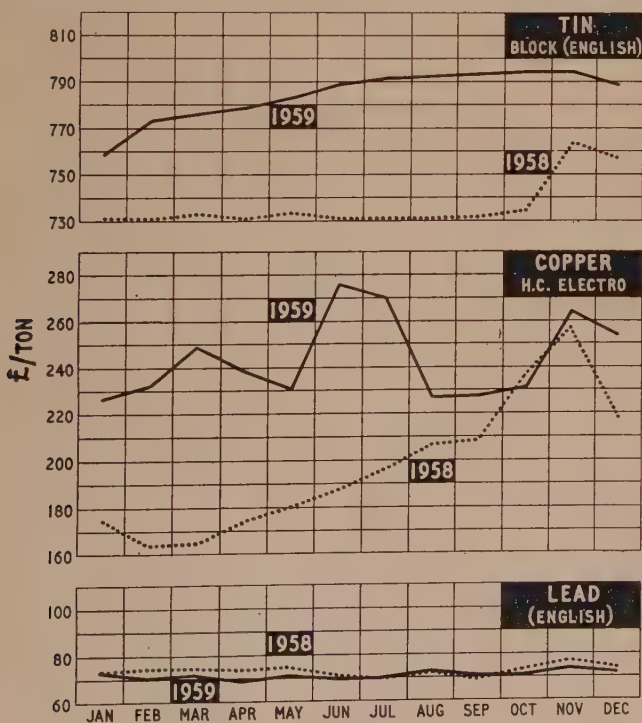
As the year closed, it became obvious that the producers would have to rescind their voluntary restriction arrangements for zinc as the new year started, although maintaining some curb on lead supplies pending an improvement in that market. A further United Nations conference is planned for January when a definite statement is expected.

ALUMINIUM.—The major United States aluminium producers' desire to ensure overseas fabricating outlets for their metal resulted in the Aluminum Co. of America (Alcoa) and Reynolds Metals, through its Reynolds Metals/Tube Investments interests in this country, both being involved at the beginning of the year in the now historic battle for control of British Aluminium. Not to be entirely thwarted by Reynolds' victory in mid-January, Alcoa has since joined with I.C.I. in setting up a new concern, Imperial Aluminium.

From 1st January the Canadian aluminium producer discontinued its 2 per cent "loyalty" rebate to regular United Kingdom customers. With material very much in over-supply, however, it offered to hold prices in the first half of 1959 at ruling levels or lower. Initially conditional, this offer subsequently became unconditional following a similarly improved offer by the American producers to their domestic customers.

Supplies became even more plentiful here in the second quarter with the reappearance of cheap Russian offerings, although, indeed, Russian prices were fully matched by ingot from France. West Germany, Norway, Switzerland and Austria, as well as other East European countries, also exported aluminium to the United Kingdom in this period and the cheaper prices eventually fell to some £170 a ton delivered, whilst Canadian and American aluminium remained at £180.

Later, the accumulation of stocks in producers' hands reached unduly high levels and all the big North American producers made reductions in their operating rates. At one time, the Canadians were operating at only 65 per cent of capacity. Coincidental with this to some extent was a marked falling off again in United Kingdom supplies of cut-price ingot from Europe, occasioned partly by the fact that West European producers were enjoying improved demand from their domestic or traditional



markets and thus progressively withdrawing from the British market.

The North American position is now somewhat undecided. New labour contracts to replace those which expired in August have yet to be agreed, failing a steel industry lead so far. The disruptive effects of the American steel strike, however, reached aluminium and caused the major producers to announce fresh production cuts, thereby eliminating the gains made during the third quarter. Canada, however, which is the world's biggest aluminium exporter and thus has a large stake in the more healthy European economy, is having to increase its output to keep pace with the demand. Just before Christmas, it also raised its price to all outside markets, except the United States, by $\frac{3}{4}$ cent a lb, thus bringing its United Kingdom ingot price to £186 a ton delivered. The American producers followed suit almost at once with their export prices.

In Britain, too, production of aluminium sheet and strip has been going on at full pace in recent weeks. The boom in the motor industry is also reflected in the improved demand for secondary aluminium alloy ingots—and of scrap for making them—of which there has been ample evidence in the last quarter.

IRON AND STEEL.—The British steel industry entered 1959 with depleted order books as a result of the steady running down of stocks by consumers from late 1957 onwards. In the early part of the year ingot production ran at about 75 per cent of capacity, but the works producing heavy steel were sometimes down to 60 per cent. By the spring, however, there were signs of improvement in the demand for lighter products and the call for sheets, which had never fallen off because of the high rate of the motor car industry's activity, was intensifying.

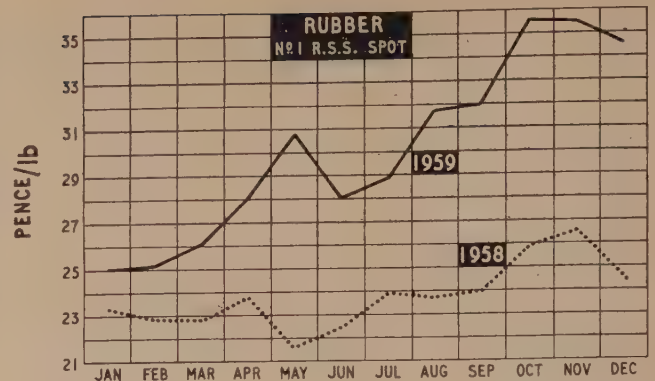
In June, there were changes in the United Kingdom home steel price structure designed to encourage consumers to order bigger quantities of a size and thereby enable mills to have longer and more economic runs. During the summer, too, the Americans, in preparation for the threatened steel strike, were buying overseas on a big scale, not least in the United Kingdom. And all the time internal demand here was building up; even the requirements of plates and heavy sections were slowly improving.

In the late autumn it became clear that although there had been some improvement in actual consumption of steel, a growing amount of material was moving into stock as consumers built up the reserves they had run down previously. Steel production rose rapidly in October and November to reach 95 per cent of capacity. Delivery delays of many products continued to lengthen, but apart from cold reduced sheets no shortages occurred. Teething troubles at two strip mills where new plant was being run in, coming at a time when demand was expanding rapidly and when the American steel strike had resulted in a general world shortage of cold reduced sheet steel, created difficulties for a number of consumers.

The industry is now pressing forward with plans to boost sheet steel production considerably by the early 1960's.

It seems certain that the steel industry in 1959 will have produced close on 20 million tons of raw steel; if demand is maintained it will be able to produce anything up to 24 million tons in 1960.

RUBBER.—With the general economy in the United States and in Europe better in 1959 than in the previous



year and a larger motor car demand, the rubber industry experienced a favourable year: especially as the market was considerably influenced by strong buying of natural rubber by Russia and other Communist countries. After starting the year at just over 2s/lb the London price for No. 1 ribbed smoked sheet rose to about 2s 7d early in May and after a temporary setback later continued to climb until in October it was practically up to 3s, with spot supplies distinctly scarce. The United States Government in September announced that it would sell 470,000 tons from its stockpile over nine years and in October the Board of Trade announced its proposals for disposing of about 100,000 tons of rubber from its stockpile. The upward pressure on prices naturally eased somewhat although, with quotations currently about 2s 11d/lb, the price level must be considered satisfactory from the producers' point of view.

American demand in the latter part of the year was affected to some extent by the steel strike and its repercussions on rubber-consuming industries.

World output of natural rubber in 1959 is expected to have amounted to about 2,055,000 tons, an increase of about 70,000 tons over 1958, Malaya and Indonesia both showing significant increases. Total world consumption may have amounted to 3,550,000 tons, indicating a consumption of about 1,500,000 tons of synthetic rubber. As at present foreseen, there should be a fairly ready market in 1960 for all the natural rubber that can be produced.

Work Study Glossary

THE recently published British Standard glossary of terms, B.S. 3138, was drafted by a specialist committee under the chairmanship of Mr. R. M. Currie, head of the central work study department of I.C.I., Ltd., assisted by representatives of the British Employers' Confederation, Trades Union Congress, European Productivity Agency, Ministry of Labour, Department of Scientific and Industrial Research, British Institute of Management, Work Study Society, and the major engineering institutions.

The first part of the 38-page glossary defines work study, method study and work measurement, part 2 defines terms recommended for use in method study and the third section contains a large number of terms and definitions relating to work measurement. Time study techniques have now been extended from repetitive work to other forms including engineering maintenance and construction. The glossary covers these techniques and recommends the adoption of a standard scale of rating and performance uniform for work of all types. An appendix contains terms used in specialised fields closely associated with work study, and throughout the glossary preferred terms are listed in bold type while non-preferred synonyms are printed in lighter type. Copies may be obtained from the British Standards Institution, Sales Branch, 2, Park Street, London, W.1, price 7s 6d.

OVERSEAS ELECTRICAL TRADE

FURTHER RISE IN EXPORTS IN NOVEMBER

BRITISH electrical exports in November continued their upward trend, although the rise was not so steep as for the preceding month. The total value for November of £20.7 million compares with £20.4 million for October and similarly for November, 1958, and the total for the eleven months (January to November) was £211.8 million, an increase of £8.3 million as compared with the corresponding period of 1958. Exports to Commonwealth countries were generally well maintained and out-

side the Commonwealth the United States increased its purchases by nearly £400,000.

With one exception—converting machinery, mercury-arc rectifiers and switchgear—all the main groups shared in the month's improvement, electronic and radio equipment once again showing the largest increase. The shipments of converting plant, etc., at £2,278,552 were over £1 million less than for October, but monthly fluctuations in capital plant are necessarily greater than for the smaller

TABLE 1.—ELECTRICAL EXPORTS

Class	Month of November 1959	Eleven months ended 30th November 1958	Eleven months ended 30th November 1959	Class	Month of November 1959	Eleven months ended 30th November 1958	Eleven months ended 30th November 1959
	£	£	£		£	£	£
Generating sets and generators:				Cookers	50,892	607,424	436,238
Diesel-driven, up to 10 kW	122,797	1,279,148	1,221,017	Toasters	30,508	271,850	207,219
Ditto, 10 to 65 kW	120,636	2,227,354	1,480,507	Other cooking apparatus	48,242	355,068	435,621
Ditto, 65 to 200 kW	80,709	2,028,201	1,684,947	Parts and accessories	88,109	720,560	971,287
Ditto, over 200 kW	230,647	4,607,247	2,917,920	Space heating appliances	47,038	360,890	294,954
Spark ignition engine driven	7,649	159,551	115,186	Water heating appliances	31,502	289,480	311,966
Steam turbine driven	70,147	753,605	676,646	Other heating appliances	34,751	315,397	311,072
Hydraulic turbine driven	—	17,542	—	Parts and accessories	114,453	775,648	918,920
Other prime mover driven	915	264,178	368,697	Irons	105,615	851,538	816,982
Generators, not exceeding 200 kW	116,501	1,442,164	1,110,468	Arc welding equipment, a.c.	59,743	504,856	408,399
Ditto, over 200 kW	23,491	921,655	856,955	Ditto, d.c.	48,049	797,187	522,748
Parts of generators	1,065,056	7,430,606	7,684,572	Resistance welding equipment	19,269	169,187	356,894
Motors, complete, other than railway, tramway and trolley-bus:				Electric furnace plant	77,854	1,174,819	947,073
Up to ½ h.p.	230,816	1,703,791	1,931,435	Magnetos, ignition	8,855	165,854	132,364
Over ½ but under 1 h.p.	68,438	529,154	553,848	Spark plug	179,220	1,666,563	1,825,163
1 h.p. to 250 h.p.	458,970	4,961,460	4,686,182	Elec. appliances for aeroplanes, n.e.s.	282,613	3,054,191	3,589,176
Over 250 h.p.	213,167	1,333,984	2,209,214	Ditto, for motor vehicles, n.e.s.	555,126	5,256,049	4,569,341
Railway, tramway and trolley-bus motors complete and parts of all motors	365,396	2,295,002	2,834,858	Ditto, for cycles, n.e.s.	50,912	573,948	447,677
Motor starting and controlling gear	322,049	2,861,353	3,477,482	Signalling app. (incl. traffic signals)	139,510	1,559,588	2,210,380
	3,497,384	34,815,995	33,809,934	Instruments, commercial	190,549	1,918,021	1,894,100
Converting machinery	39,423	333,867	532,342	House service meters (including parts)	177,896	1,621,371	1,534,632
Mercury-arc rectifiers	30,948	1,107,753	737,841	X-ray apparatus (excl. tubes and valves)	44,839	549,071	361,110
Transformers for lighting, heating and power (incl. coils):				Electro-medical apparatus	35,160	572,977	556,756
Not exceeding 7,500 kVA	273,442	6,473,122	5,084,798	Ceiling fans, complete	63,765	1,110,751	872,621
Over 7,500 kVA	740,867	4,950,433	5,480,746	Desk fans, complete and parts of desk and ceiling fans	61,239	353,880	282,664
Switchgear and switchboards (not telegraph or telephone), up to 200 A and 660 V	330,745	4,448,937	3,883,523	Vacuum cleaners	156,478	1,361,409	1,528,780
Ditto, other	863,127	11,265,726	12,725,631	Floor polishers	85,546	807,678	775,808
	2,278,552	28,579,838	28,444,881	Food mixers	106,774	665,275	778,246
Primary batteries:				Hair clippers and dry shavers	84,063	604,871	625,585
Lighting	106,708	1,002,847	1,082,739	Other portable appliances	32,273	191,417	259,165
Radio	375,079	3,428,014	3,835,945	Parts	197,286	1,164,476	1,505,520
Other	34,165	480,096	391,387	Portable elec. tools (not saws) and parts	246,118	2,271,583	2,324,970
Parts (excl. carbons)	49,033	514,062	530,202				
Lamps:				Cables and wires:			
Filament, exceeding 28 V	93,115	906,559	991,534	Telegraph and telephone, submarine	40,194	706,458	4,096,467
Ditto, under 28 V	37,472	331,313	313,566	Ditto, other	380,477	5,745,846	4,084,598
Arc lamps and searchlights	11,578	201,122	170,870	Cotton, silk or art. silk insulated	32,301	441,064	221,095
Discharge lamps, fluorescent tubes, etc.	91,855	980,489	985,818	Enamel, glass or asbestos insulated	116,996	1,146,260	1,021,823
				Paper insulated	455,384	7,033,455	5,828,366
Radio and television, etc., apparatus:				Rubber insulated	294,935	4,797,751	3,165,056
Thyratrons, hot cathode mercury vapour and gas-filled rectifiers (excl. mercury-arc rectifiers), photo-electric cells, stabilising and cold cathode valves, magnetrons, klystrons	35,222	295,368	464,703	Thermoplastic insulated	283,903	2,146,672	2,855,875
All other*	463,728	4,713,407	5,338,800	Other	191,563	2,448,360	1,802,608
Parts (excluding glass bulbs)	27,834	233,499	336,391				
Radio and television transmitters	71,656	372,489	984,355	Accumulators for motor vehicles	131,043	1,669,266	1,544,937
Commercial radio and radar equipment	2,199,419	13,289,365	17,785,805	Ditto, traction	10,210	220,138	205,653
Domestic radio receivers, mains	69,704	936,275	921,660	Ditto, radio and other portable	43,742	568,184	355,225
Ditto, battery	65,923	573,836	647,223	Ditto, other	31,632	358,039	551,343
Ditto, other (incl. car)	25,698	247,902	330,770	Parts and accessories	104,589	1,002,350	922,711
Radiograms	33,730	392,895	280,338	Electric wiring accessories	207,860	1,902,615	2,240,100
Television sets	90,407	866,744	719,547	Elec. ceramic ware, etc. (incl. insulators), n.e.s.	118,026	1,185,500	1,108,262
Public address equipment	89,205	999,788	1,022,360	Insulating cloth and tape	85,105	550,479	625,073
Other radio and television apparatus, n.e.s.	138,036	368,125	825,824	Other insulating material	149,408	1,081,704	1,518,462
Components and parts, n.e.s.	1,070,938	8,221,880	9,209,091	Permanent magnets	52,090	510,261	511,942
	4,381,500	31,511,573	38,866,867	Radio, telegraph and telephone testing equip., n.e.s.	110,795	814,904	1,370,067
Telegraph and telephone installations	725,248	8,221,791	7,799,846	Scientific elec. instruments (excl. telegraphic or telephonic, time recorders and time switches)	333,406	3,912,064	3,833,400
Telephone instruments, separately consigned	124,324	1,659,474	1,118,060	Electrical machinery, n.e.s.	41,487	875,031	453,168
Telegraph and telephone parts	743,581	8,692,700	8,379,386	Electrical apparatus and appliances, n.e.s.	1,221,080	9,403,672	11,046,813
Line apparatus for long distance communication	236,689	1,960,396	2,669,991				
	1,829,842	20,534,361	19,967,283	TOTAL	20,676,936	203,469,219	211,773,501

* The figures for 1959 are not strictly comparable with those for 1958.

TABLE 2.—DISTRIBUTION OF EXPORTS (TABLE 1)

Country	Month of November 1959	Eleven months ended 30th November 1959	
	£	£	£
Gibraltar	16,135	299,448	112,253
Malta and Gozo	57,741	621,766	509,758
Cyprus	69,885	775,874	641,358
Sierra Leone	23,167	589,797	389,463
Ghana	247,287	1,769,135	2,583,247
Nigeria	397,129	4,139,385	5,065,079
Union of South Africa	1,457,948	17,365,773	17,073,330
Rhodesia and Nyasaland	756,816	4,970,037	6,965,904
Tanganyika	64,839	492,284	490,152
Kenya	117,681	1,452,904	1,844,009
Uganda	28,234	616,548	463,817
Mauritius	65,446	413,020	566,546
Aden	46,536	598,801	538,841
Bahrain, Qatar and Trucial States	212,333	1,217,750	1,230,997
Kuwait	214,660	1,856,492	2,141,021
India	2,038,276	16,885,802	19,147,783
Pakistan	185,017	2,356,574	2,522,826
Singapore	193,981	3,565,703	2,636,186
Federation of Malaya	184,938	3,301,752	2,409,540
Ceylon	184,512	1,737,718	2,076,127
British North Borneo	48,153	219,636	156,758
Sarawak	6,833	245,429	144,579
Hong Kong	335,819	3,296,319	4,408,745
Australia	2,015,480	17,413,302	18,013,422
New Zealand	1,039,432	12,414,779	8,591,258
Fiji	17,409	319,409	289,950
Canada	1,698,746	12,841,378	12,455,718
Jamaica	166,808	1,529,481	1,589,405
Barbados	24,810	278,698	338,812
Trinidad	144,474	1,339,319	1,379,535
British Guiana	32,034	762,120	650,006
Other Commonwealth countries	211,189	1,755,485	2,253,266
Irish Republic	446,349	3,184,543	3,532,458
Soviet Union	40,894	568,940	1,126,386
Finland	128,335	1,249,267	1,173,432
Sweden	523,998	4,950,942	5,036,198
Norway	206,911	2,270,717	2,278,043
Denmark	315,916	2,051,081	2,607,330
Poland	71,603	688,045	734,831
Western Germany	464,168	3,171,934	5,611,323
Netherlands	698,852	6,870,454	6,881,879
Belgium	269,184	3,010,508	3,202,714
France	195,298	3,616,484	2,810,950
Switzerland	171,611	1,788,752	1,865,553
Portugal	151,461	2,975,043	2,093,467
Spain	71,153	1,887,811	1,733,310
Italy	267,610	2,998,802	3,335,626
Austria	47,774	515,677	487,269
Yugoslavia	41,707	668,160	755,105
Greece	131,683	899,867	1,232,014
Turkey	55,184	1,023,072	638,300
Belgian Congo	31,661	406,029	577,408
Portuguese East Africa	43,233	262,198	302,758
Egypt	100,964	1,206,565	1,558,127
Libya	26,669	705,694	714,315
Morocco (excluding Tangier)	12,099	429,043	302,380
Sudan	88,121	1,021,454	948,870
Syria	19,116	311,310	245,500
Lebanon	61,081	486,213	577,823
Israel	94,463	1,241,121	1,099,621
Jordan	79,075	824,310	813,835
Saudi Arabia	37,138	839,638	575,908
Iraq	243,496	3,093,554	2,902,114
Iran	440,905	3,731,173	3,253,022
Burma	54,577	853,323	1,114,281
Thailand	29,854	1,181,116	848,663
Indonesia	89,751	316,550	493,120
Japan	45,515	467,938	726,464
United States of America	1,328,198	7,859,468	13,562,148
Cuba	45,891	761,037	373,343
Mexico	79,150	573,519	577,673
Colombia	35,624	351,067	356,375
Venezuela	386,904	4,446,089	3,968,893
Peru	29,414	466,799	352,901
Chile	51,386	530,241	974,036
Brazil	70,731	1,025,273	849,511
Uruguay	14,316	74,753	93,451
Argentine Republic	112,403	3,585,019	2,103,955
Other foreign countries	461,582	4,586,708	4,331,277
TOTAL	20,676,756	203,469,219	211,773,501

TABLE 3.—SOURCES OF ELECTRICAL IMPORTS

Country	Month of November 1959	Eleven months ended 30th November 1959	
	£	£	£
Australia	71,960	685,735	495,308
Canada	96,850	869,496	983,192
Other Commonwealth countries	206,874	1,216,287	1,747,617
Irish Republic	122,878	811,815	1,059,300
Sweden	81,469	1,037,296	1,049,575
Denmark	68,404	561,718	615,429
Western Germany	727,569	5,182,400	6,967,778
Netherlands	604,831	3,806,131	5,744,588
Belgium	38,440	551,353	463,235
France	205,610	1,145,376	1,689,037
Switzerland	122,745	1,430,595	1,557,711
Italy	117,967	723,892	1,003,679
United States of America	1,005,372	7,271,219	10,293,443
Other foreign countries	160,551	1,490,531	2,437,352
TOTAL	3,631,520	26,783,844	36,107,244

equipment. The principal markets for generating sets and motors were Canada, South Africa, India and the United States in that order, and the total value of £3,497,384 was £400,000 better than the figure for October.

The United States was the best market in November for converting machinery, mercury-arc rectifiers and switchgear, and with purchases valued at £490,164 passed the best of the Commonwealth markets (Australia, £237,658) by more than £200,000. In the electronic and radio equipment group, the largest shipments went to India, which took equipment valued at £677,443. Other good markets were Australia (£451,300) and Canada (£412,588), while among the foreign countries, the Netherlands made purchases valued at £281,563, Sweden £228,291 and the United States £221,452.

In the cables and wires group, India, with purchases of £207,976 and New Zealand with £142,011 were the principal Commonwealth markets, while Venezuela continued as an important customer with purchases valued at £200,162. The demand for the smaller appliances, including domestic electrical equipment, remained good.

There was little change in the pattern of electrical imports, electronic, radio, television and radar equipment continuing to form the largest group. The total value of imports for November was £3.6 million, £300,000 less than for October, but nearly £900,000 more than for November, 1958.

TABLE 4.—OTHER ELECTRICAL AND ALLIED EXPORTS

Class	Month of November 1959	Eleven months ended 30th November 1959	
	£	£	£
Washing machines, electrically operated:			
Not exceeding 150 lb weight	557,149	3,616,378	3,433,768
150 lb to 250 lb	60,548	856,173	559,345
Parts	96,916	897,702	888,900
Electric locomotives (incl. battery types)	354,160	3,660,756	4,998,189
Diesel locomotives with electrical transmission	19,160	1,732,608	2,970,962
Welding electrodes:			
Ferrous	105,943	958,693	1,033,474
Non-ferrous	28,733	296,664	239,214
Electric conduit tubes and cased tubes	73,102	606,009	679,224
Electric carbons	124,046	547,153	1,176,459
Electric lighting fittings and lanterns (excl. arc lamps, searchlights and cycle lamps)	318,043	3,421,185	3,264,928
Electric fork-lift trucks	100,481	709,724	846,698
Water turbines	460,423	2,297,417	3,828,762
Steam turbines	793,573	6,613,408	9,812,481

TABLE 5.—ELECTRICAL IMPORTS

Class	Month of November 1959	Eleven months ended 30th November 1959	
	£	£	£
Generators, incl. parts	103,453	840,387	854,827
Motors, incl. parts	156,996	1,007,335	1,428,623
Converters; transformers; rectifiers*	176,594	352,271	1,125,302
Switchgear and switchboards (not telegraph and telephone)	83,399	574,901	1,000,480
Cathode ray tubes, complete	135,137	448,227	1,590,247
Other valves, complete*	262,581	2,024,638	2,700,176
Parts (excl. glass bulbs)*	168,536	403,582	890,826
Radio receiving sets, domestic or portable	57,374	199,177	365,930
Radio communication and navigational aids, complete	356,441	3,233,008	4,311,224
Other radio and TV apparatus, parts and accessories	270,581	3,552,624	3,603,593
Apparatus for telegraphy and telephony	28,710	1,285,566	879,209
Welding machinery	48,147	317,435	598,153
Cooking and heating apparatus	131,098	1,460,885	1,539,506
Magnetos, ignition, and electric appliances for aeroplanes, motor vehicles and cycles	264,028	2,374,086	2,097,940
Electro-medical apparatus (incl. X-ray apparatus)	78,565	707,550	928,257
Portable mechanical appliances, electrically operated, complete	165,661	991,854	1,290,163
Parts	62,725	766,009	612,967
Scientific electrical instruments (excl. telegraphic and telephonic)	144,881	1,769,351	1,641,749
Other machinery, apparatus and appliances	936,613	4,474,958	8,648,072
TOTAL	3,631,520	26,783,844	36,107,244

* The figures for 1959 are not completely comparable with those for 1958.

GENERATION and DEVELOPMENT

Hydro-Electric Plant Contracts

The North of Scotland Hydro-Electric Board has placed orders for turbo-generating plant for its power stations at Livishie (Glenmoriston, Inverness-shire) and at Loch Glashan (Loch Fyneside, Argyllshire).

The 21,200 b.h.p. vertical Francis turbine for the Livishie station will be manufactured by the Harland Engineering Co., Ltd., Alloa, which will also supply the main valves and associated equipment. The Heavy Plant Division of Associated Electrical Industries, Ltd., is to supply the 15 MW generator. The generating plant will be designed to operate by automatic control both within the station and from a remote point.

For the Loch Glashan station the Harland Co. is supplying an 8,500 b.h.p. horizontal Francis turbine which will drive a 6 MW generator manufactured by the A.E.I.

The electrical and mechanical consulting engineers for the Livishie station are Messrs. Kennedy & Donkin and for the Loch Glashan scheme Messrs. Strain & Robertson.

Cost of Supplying Remote Areas

The "ill-favoured, irresponsible, and unjustified criticism" directed against the North of Scotland Hydro-Electric Board from various quarters was answered by Lord Strathclyde, chairman of the Board, after he had completed a tour of construction sites in Inverness-shire. The Board, Lord Strathclyde said, had not neglected a single aspect of Highland development or means of increasing the welfare and prosperity of those who lived within the area. It was obliged to balance its books, taking one year with another; therefore it could give a supply in cases which entailed a loss only by bringing the accounts into balance by profits from sales of electricity in Southern Scotland.

Lord Strathclyde's statement was referred to at a subsequent meeting of Inverness-shire County Council when the convener, Mr. F. W. Walker, C.B.E., said he felt that the Government should make a special grant to the Hydro Board to meet the abnormal costs of supplying remote areas.

Farmers Object to Supergrid Line

Work on a 275 kV line was held up when two farmers refused entry to land at Halton, near Lancaster. The farmers claimed that the amenities of the village would be spoiled and the value of their land reduced. The North West, Merseyside and North Wales Region of the Central Electricity Generating Board issued a statement pointing out that the section under dispute had been the subject of careful study in consultation with the County Council and other bodies. The

alternative routes put forward by the farmers had been discussed at an inquiry, but the result was that the route for which the Board applied had been approved. While regretting that it had been unable to meet the objections of the farmers, the Board considered that it was essential in the national and regional interests for the work to proceed.

M.E.B. New Gloucester Premises

New headquarters for the Central Gloucestershire Sub-Area of the Midlands Electricity Board have recently been completed in Eastern Avenue, Gloucester. Three storeys high, the building is L-shaped with the centre block incorporating the main entrance hall.

The electrical installation was designed by the Commercial Department of the Sub-Area and installed by Gloucester District staff. It was decided to use the G.E.C. double-duct rising main. This has enabled power sub-circuits from floor level and high level lighting circuits to reach points of sub-distribution with the minimum of trunking and has facilitated the construction of the building in three phases. Power, lighting and heating supplies are taken off the rising mains on each floor.

The rising mains in each phase of the building operate independently and are fed from a site substation in the grounds surrounding the building. Phase 1 is 300 A, double-ducted four bar riser; phase 2 has 400 A double-duct, while phase 3 is the same as phase 1. G.E.C. switchgear is used in the installation and distribution is from the company's distribution boards mounted on the rising mains. False ceilings in the passage-ways provide through-ways for the cable trunking runs. All the lighting trunk-

ing has been supplied by G.E.C. and the company's "Mutac" plaster depth switches are used throughout the building. The company has also supplied some 500 fluorescent lamp-ways and in collaboration with M.E.B. engineers has designed special cold-cathode fittings for the entrance hall, stairways and landings. A special feature in the Hollerith accounting machine room is the adaptation of standard G.E.C. lighting trunking to provide power take-offs for the machines. Skirting trunking used throughout was manufactured and supplied by Walsall Conduits, Ltd., and contains double compartments allowing for easy interconnection between offices for telephones and power circuits. A floor warming system, of B.I.C.C. manufacture, with a total loading of 350 kW has been installed.

Chapelcross Nuclear Power Station

On Sunday last the fourth (and last) of the reactors of the Chapelcross (Dumfriesshire) nuclear power station began operation. The first of the reactors and its generating plant was put into service last February.

Londonderry Plant in Operation

The new power station at Coolkeeragh, Londonderry, began operation on 19th December, when one 30 MW unit was brought into use to supply power to the 110 kV grid system in the north-west area outside the city. The power station is oil-fired and is the first of its kind in Northern Ireland. Proposed extensions include another 30 MW unit which will come into operation in March next and a 60 MW unit which will be operating in 1961.



The Hollerith accounting machine room at the M.E.B. Central Gloucestershire Sub-Area headquarters showing the special power take-offs from standard G.E.C. lighting trunking

INDUSTRIAL NEWS

Japanese Nuclear Power Contract

A *Reuter* message from Tokyo reports that a formal contract was signed on 22nd December for the import into Japan of a British Calder Hall type nuclear reactor for the first nuclear power station in Asia. Mr. Yasukawa, president of the Japan Atomic Power Generating Co., and Mr. R. N. Millar, a director of the General Electric Co., Ltd., signed the contract.

The contract price, which covers the import and installation of the reactor, is 19,900 million yen (about £19.9 million), a large part of which will be paid in sterling. The reactor is to be completed within fifty-four months after the contract takes effect. The Japanese Government has already approved the contents of the contract.

A G.E.C. spokesman said that the import of the components will begin early in January, and the reactor is expected to be completed early in 1964. The total cost of the project is estimated at about £34 million. The Japan Atomic Power Generating Co. said that the British group agreed to grant a credit of about £8 million to help finance the sterling part of the cost, which amounts to £11.8 million. The British group will send about sixty engineers and technical experts to Japan to direct and supervise the work. The station will be erected at Tokaimura, seventy miles north-east of Tokyo and will have a capacity of 150 MW. It has been specially designed to withstand earthquake shocks. The fuel is to be purchased by separate agreement from the United Kingdom Atomic Energy Authority.

British Exhibition in New York

Demand by engineering firms for stand space at the British Exhibition to be held in New York from 10th to 26th June, 1960, has been so great that the engineering section has had to be enlarged. In addition to the whole of the third floor of the Coliseum Building, the engineering section will now also occupy about one-third of the second floor, where the main display will be of consumer goods. The first floor (equivalent to our ground floor) will be devoted to a Government exhibit (using new techniques) of some of Britain's industrial and scientific achievements and to collective displays by the iron and steel industry, the shipbuilding industry and by other bodies, including the B.B.C., the Port of London Authority, and the London clearing banks. On the fourth floor there will be an English inn, a cinema, and a supermarket and other shops selling British goods, including trade and technical journals.

The exhibition, which is the largest undertaken by the organisers, British Overseas Fairs, Ltd., is expected to

attract about half a million visitors. It is hoped that at least 25,000 of these will be trade buyers, and certain hours will be reserved for them. The exhibition will occupy the whole of the Coliseum Building, which has a gross area of 391,500 sq ft, and there are expected to be between 400 and 500 exhibitors. The exact number, and their names, will not be known until space is finally allocated early in the New Year. A British military tournament and tattoo will be held in the Madison Square Garden from 18th June to 4th July.

Shop Lighting in Leeds

The first stage of an interesting project has just been completed in Leeds. As part of its shop lighting campaign programme the British Lighting Council's Regional Advisory Committee for Yorkshire decided to help in the relighting of a local independent shop. The Leeds and District Chamber of Trade was approached, and through its good offices a scheme was planned for Mr. E. S. Ladle, who owns a grocer's shop in Austhorpe Parade, Crossgates, Leeds, 15. The existing installation was an example of complete absence of planning. Inside the shop general light came from bare warm white tubes in batten fittings on the ceiling. The window area is in three sections, each of which had one 80 W tube, reinforced in the bacon section by 1,600 W of filament lighting, some behind red colour media.

In the relighting the total load for the shop has been increased only slightly, from 2.4 kW to 2.7 kW (excluding control gear losses). The interior is lighted mainly by three diffusing fittings using two 80 W de-luxe natural tubes, while some of the old fittings have been used, concealed behind beams, to give extra brightness towards the back. Each of the three sections of the window receives the same treatment. The top has been boxed-in, and recessed into the new soffit are three "eye-ball" fittings for 150 W filament reflector lamps, and one louvred fitting for three 40 W tubes. The panel of clear glass over the entrance has been replaced by diffusing material carrying the proprietor's name; this is lighted by a 40 W white reflector tube. The fila-

ment lighting for the window is split between two circuits, six "eye-balls" on one, and the remaining three, equally spaced, on another, both being controlled by time switches for after-hours lighting.

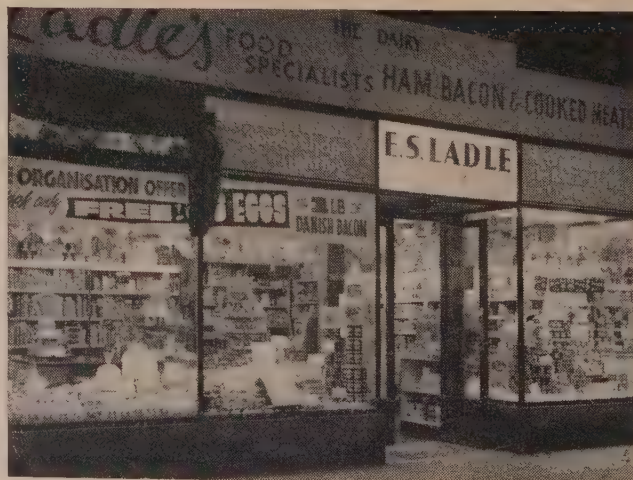
Records are being specially kept so that it will be possible to see how the new lighting affects the numbers of people coming into the shop, the weekly turnover, and the success of the business generally. The total cost, including joinery, lighting equipment, and complete re-wiring, was approximately £250. The equipment was supplied by B.L.C. member companies, and the contracting work was carried out by the Yorkshire Electricity Board. The scheme has been carried out under the guidance of Mr. J. W. Howell, the B.L.C. engineer for the Yorkshire Region.

Refrigeration Exhibition

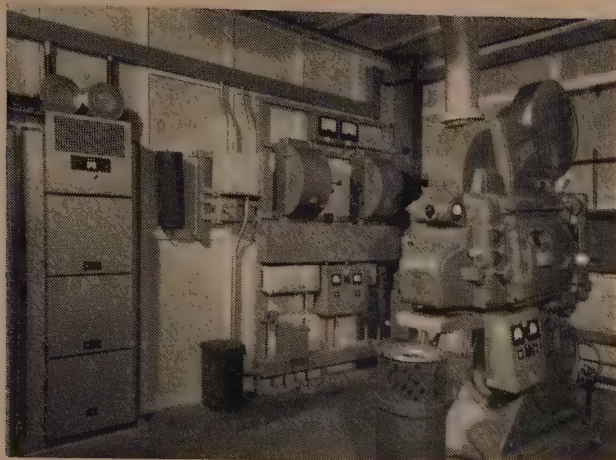
The first Industrial and Commercial Refrigeration Exhibition will be held at the Old Hall of the Royal Horticultural Society, London, S.W.1, from 15th to 17th February next.

Industrial Machinery Merchants

The Association of Industrial Machinery Merchants held a general meeting at the Waldorf Hotel, London, on 10th December under the chairmanship of the president of the Association, Mr. H. Vernon, of Thos. W. Ward, Ltd. In the morning session the members reviewed the work of the Association and in particular the news bulletins in which details of overseas inquiries were given. It was decided that, in addition, the bulletins should include the requirements of individual members; details of visits from overseas trade delegations; information on variations in credit restrictions; and any additional matters on exports generally which members



The exterior of a Leeds grocer's shop which has been re-lighted under the guidance of the British Lighting Council Yorkshire Regional Committee



The projection room at the Empire Theatre, Leicester Square

would find to be valuable. The meeting also considered the possibility of closer liaison with other associations in the industrial machinery merchant field.

After luncheon Mr. H. E. Reed, the deputy president, presided at an informal session at which members were given the opportunity to discuss various matters appertaining to the Association itself, and how it could be of benefit to the members. It was agreed that the first annual general meeting of the Association should be held on 11th March next in London, at a venue to be agreed, and should be followed in the evening by an informal dinner and dance for members and their guests.

Anglo-Polish Trade Talks

Discussions have taken place in London between the Polish Trade Delegation and the United Kingdom Government on the terms of a new trade arrangement, to replace the three-year trade arrangement of 31st December, 1956, and on the level of trade in 1960. The two delegations have been unable to reach agreement on these matters and discussions have, therefore, been suspended. It is hoped to resume discussions in the spring.

In the meantime, agreement has been reached on the extension of the validity of the current trade arrangement until 30th June next, and on the establishment of quotas for the import of each others' goods during the period equal to 50 per cent of the quotas agreed for 1959.

Reconstruction of London Cinema's Electrical Services

Considerable reconstruction of the technical services of the Empire Theatre, Leicester Square, have recently been carried out. This commenced with the removal of the "theatre mains" by the London Electricity Board, necessitating the installation of a new independent secondary lighting system with a load of 4 kW. This consisted of a 230 V "Nife" battery system with a "Neverfayle" charger and control unit. A certain amount of rewiring was also required

for the auditorium. All this work was carried out without interruption to the normal programme, mainly at night.

The recent production of "Ben Hur" necessitated a 52ft picture, which required a completely new projection room placed in the centre of the stalls. The "Super Cinex" lamps are capable of a loading of up to 165 A, for which three silicon type rectifiers (Hackbridge & Hewittic) were installed. Be-

cause of the high loading and cost of mirrors, water cooling was necessary with attendant safety devices. Furthermore, two special ventilating plants were required, one to deal with lamp extract and the other for the booth ventilation. The projectors, which were manufactured by Philips Electrical, Ltd., and supplied by Frank Brockliss, are of the latest type and take 35 mm and 70 mm film with ten sound channels, six of which are used for "Ben Hur." Sound equipment ("Westrex") includes not only the usual equipment behind the screen but twenty-eight ambient speakers throughout the auditorium. The whole electrical installation was carried out in ten days by Troughton & Young, Ltd. The architects were George Coles & Partners, and the engineering consultants were A. E. Mohring & Son.

Mullard Television Premium

In order to encourage the presentation of original papers on various aspects of television, Mullard, Ltd., is offering the Television Society a new yearly premium of £20. This will be awarded by the Council of the Television Society to the author of the best paper submitted during the year and subsequently published in its journal.

Public Transport Lighting

Convertors using two transistors connected in push-pull to give high voltage a.c. from low voltage d.c. obtained from the vehicle's battery have been used in a Reading Corporation trolley-bus which has been equipped with a fluorescent lighting system. Six semi-recessed fittings each having one 20 W 2ft lamp and a plastic diffuser are installed in each saloon and one on the platform. The illumination level has been increased to an average value of 10 lumens per sq ft, more than three times the value obtained previously with 16 tungsten lamps of 15 W rating.

The transistorised ballasts, which were supplied by Philips Electrical, Ltd., are housed in a case similar to that used for normal 50 c/s fluorescent

lamp ballasts. Operation at 8,000 c/s, however, enables smaller components to be used with a consequent weight saving. The maximum load which at present can be supplied by one of these units is one 40 or two 20 W lamps, and the overall efficiency is 80 per cent.

N.F.E.A. and Restrictive Trade Practices

We referred last week to the intention of the Registrar of Restrictive Trade Practices to take action in respect of the agreement between the members of the National Federated Electrical Association. In an advertisement in this issue the Association sets out the circumstances and announces its intention of conducting a "vigorous defence" of its present arrangements. To facilitate the conduct of the proceedings, an application is to be made to the Court constituting the Association as representative respondent in the proceedings although it is still open to individual members to apply to be separately represented.

Broadcasting Service for Ghana

A high power short wave broadcasting system is to be instituted in Ghana. The contract, valued at more than £600,000, for the design and erection of the transmitting station building at Tema, near Accra, the supply and installation of the four 100 kW transmitters and ancillary equipment, masts, aerials and feeder systems has been placed with Marconi's Wireless Telegraph Co., Ltd.

The possibility of earthquake shocks and the effect of salt-laden air have been taken into account in the design of the station buildings. The transmitters operate in the frequency range 5.9 to 26.1 Mc/s. Air-cooled valves are used in all stages, and the combination of thoriated-tungsten main valves and the latest circuit techniques provides an overall efficiency of 50 per cent. Electrically operated circuits, controlled from the main panel, permit rapid retuning, any one of six pre-selected frequencies being set up by a single operator in three minutes. The aerials to be used are h.f. dipole curtain arrays suspended between lattice steel masts fed by four-wire open feeder lines. A total of six 325ft, three 235ft and four 90ft masts will support 22 aerials.

Flexible Trailing Cables

A specification dealing with flexible trailing cables for use with coal cutters and for similar purposes has been published by the National Coal Board as N.C.B. Specification No. 188/59, price 1s. Its object is to standardise in greater detail than is given in B.S. 708, "Trailing Cables for Mixed Purposes," a range of flexible cables for use with coal cutters and similar machines, and provision has also been made for cables of larger conductor size than those contained in the standard. The power cores of the

cables dealt with are suitable for systems where the voltage to earth does not normally exceed 660 V. Details of the conductor insulation, core identification, protective screens and marking are included, with information concerning tests for voltage and insulation resistance. Constructional details are given in tabular form.

Cable Contract

The Central Electricity Generating Board, on behalf of the Southern Division, has placed a contract with W. T. Henley's Telegraph Works Co., Ltd., for the cabling between Marchwood, Lynes Common, Fawley North and Fawley South substations. This cabling is in connection with a scheme to reinforce the supply to the Esso Oil Refinery at Fawley. The contract covers the supply and installation of approximately 2,500 yd of 132 kV single- and three-core oil-filled cable and over 50,000 yd of multi-core auxiliary cables and is scheduled for completion by 31st July next.

275 kV Works Substation

In our issue of 11th December we referred to the projected electric arc furnace installation at the works of Steel, Peech & Tozer, Ltd., and suggested that the 275 kV substation involved in this scheme would be the first works substation to operate at this high voltage. It is anticipated that the first part of this plant will go into operation in January, 1963.

We have now been informed by the South of Scotland Electricity Board that a contract has been concluded with Colvilles, Ltd., for an electricity supply to be available in March, 1962, to the strip mill now under construction at Ravenscraig, Motherwell. The Board's substation to be established at this plant will be supplied at 275 kV from the supergrid and the energy will be metered at 33 kV. If the work proceeds as envisaged, it appears probable that the supply to Ravenscraig may be the first industrial supply in Great Britain to be taken from the 275 kV system.

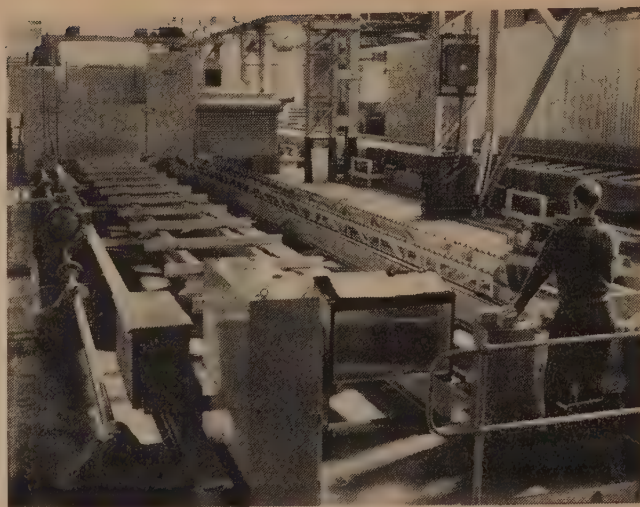
Balfour, Beatty Jubilee

Balfour, Beatty & Co., Ltd., the constructional engineers, celebrated their fiftieth year in 1959 and they have issued a book in which the history of the company is traced from its formation in 1909 by George Balfour and Andrew Henry Beatty to the present day. It includes particulars, with pictures, of some of the many thermal and hydro-electric schemes in this country and abroad in the construction of which the company has played an important part.

Yugoslavia Airfield Lighting

The Yugoslav Purchasing Commission, which recently visited Britain, has signed a contract with G.E.C. Overseas Services, Ltd., for the supply of airport lighting equipment, valued

Overall view of G.W.B. 1 MW furnaces with cooling chamber on right and charging furnace machine in the foreground at the Northern Aluminium Co., Ltd., Banbury. The furnace can accommodate loads up to 15 tons for slab lengths of 65ft and widths of 6ft 6in. Ingots of aluminium 8in thick are hot rolled at 600 deg C down to 0.3-0.5in. The heating elements are of high grade nickel chromium strip



at about £75,000, to be installed at airports at Belgrade and Zagreb. The contract covers lighting fittings, cable, transformers, regulators, switchgear and control gear. During negotiations for the contract, Yugoslav technicians visited the G.E.C. Research Laboratories at Wembley and inspected a number of airport lighting installations in Britain.

Switch and Indicator Lamp Catalogue

The complete range of switches and indicator lamps manufactured by Arcoelectric Switches, Ltd., are described in their latest 60-page catalogue, publication No. 132. Each item is illustrated photographically and by a blueprint showing the overall size and fixing dimensions. A numerical index and price list is included, and in addition list prices are quoted on every page. There are also illustrations of the company's West Molesey factory. An abridged 16-page catalogue, No. 132A, gives concise information on these products. Both are available from the company at Central Avenue, West Molesey, Surrey.

Lighting Exhibition in Jersey

Rotaflex (Great Britain), Ltd., manufacturers of lighting fittings and specialists in outdoor lighting schemes, are staging their first exhibition in Jersey from 18th to 23rd January at Swanson's Hotel, The Esplanade, St. Helier, in conjunction with the Rotaflex agents in Jersey, the Export Development Co.

George Cohen 600 Group Book

The "600" magazine of the George Cohen 600 Group, Ltd., has long been part of our reading matter, and the skill and humour of its cartoons form a welcome light relief to our everyday business activities. It is therefore pleasing to receive from the company a book, which it has published to mark the 125th year of the business, in which some 125 humorous drawings and cartoons are reproduced from among the funnier of those which have

appeared from time to time in the "600" magazine. For the more sober-minded there are also a number of excellent photographs of the activities, works and products of the group.

Power Manipulator for Berkeley Laboratories

The General Electric Co., Ltd., is to supply a power-operated manipulator for the new nuclear research laboratories being constructed for the Central Electricity Generating Board at Berkeley, Glos. The value of the order is about £12,000.

Cable Handbook

W. T. Henley's Telegraph Works Co., Ltd., has issued the 11th edition of its cable handbook, "General Information." This latest edition, which contains over 150 pages, includes a new section on the current ratings of plastic mains cables. Data includes dimensions and electrical properties of copper conductors and copper and steel-cored aluminium overhead lines; and current ratings for various conditions of installation of paper, varnished cambric, v.r. and p.v.c. insulated cables. Calculations of cable sizes are shown by means of typical examples.

Record U.S. General Electric Earnings

Strong earnings in the third quarter of 1959 brought the U.S. General Electric's earnings for the first nine months of 1959 to a new record, and sales to a level almost equal to the previous peak established in 1957.

Net sales billed for the nine months amounted to £1,122 million, an increase of 5 per cent over those during the corresponding period of 1958 and within 1 per cent of those recorded in 1957. Earnings for the nine months were £67.7 million, an increase of 17 per cent over the comparable earnings in the sub-normal period last year, and 4 per cent above the record set in 1957.

Sales during the third quarter totalled £384.6 million, 7 per cent more than during the corresponding

period of last year. Earnings for this quarter were 23 per cent more than a year ago.

Discussing the company's four principal products, the chairman, Mr. Cordiner, said that consumer products and industrial components continued to follow the improved pattern begun late last year. Sales by the defence product departments remained firm. Shipments of heavy electrical equipment had stabilised at a level below that of last year, but there had been a substantial improvement in new orders during the third quarter.

Price Increases

The British Central Electrical Co., Ltd., announces that owing to increased costs of raw materials, manufacturing and other normal overheads, the list prices of its range of handlamps and spare parts have been increased. The increases range from 1s 8d for the "Standard Gripper" handlamp, which now has a list price of 21s 8d, to 2s 4d for the "Wellglass Gripper" handlamp, which now has a list price of 36s. Some spare parts have also been increased in price. All price increases take effect as from today (Friday).

Prices of Materials

In the accompanying table we give the basis prices of the more important materials used in the electrical

ALUMINIUM ingots	ton	£186	os	od		
COPPER, H.C. Electro	ton	£262	10s	od		
Fire Refined 99.70%	ton	£261	os	od		
Fire Refined 99.50%	ton	£260	os	od		
COPPER Tubes	..	lb	2s	6½d		
Sheet	..	ton	£292	os	od	
H.C. wire and strip	..	ton	£309	15s	od	
LEAD, English	..	ton	£74	10s	od	
Foreign	..	ton	£73	os	od	
MERCURY	..	flask	£71	10s	od	
TIN, block (English) ..	ton	£785	10s	od		
ZINC, G.O.B. Foreign	ton	£95	15s	od		
BRASS Tubes (solid drawn)	..	..	lb	2s	1d
Wire	..	..	lb	2s	10½d
PHOSPHORBRONZE	..	..	lb	4s	3½d
Wire	oz	£28	10s	od
PLATINUM
RUBBER, No. 1 R.S.S. spot	lb	34½d—34½d

industry. The figures given are the selling prices and are those quoted on Tuesday last.

New Year Holiday

The works of Bruce Peebles & Co., Ltd., Edinburgh, closed yesterday for the New Year holiday and will re-open on 6th January.

Dispute at Shell Centre Site

The Minister of Labour is setting up a Committee of Investigation to inquire into the causes and circumstances of the dispute between the employers' and workers' sides of the National Joint Industrial Council for the Electrical Contracting Industry, concerning the terms and conditions of employment of members of the Electrical Trades Union employed by F. H. Wheeler & Co., Ltd., at the Shell Centre site, South Bank, London.

The Committee will furnish a report to the Minister with its recommendations.

Trade Announcements

From today (Friday), for reasons of group policy, the distribution of "His Master's Voice" and "Marconi-phone" radio and television receivers and radiogramophones will be carried out by the **British Radio Corporation, Ltd.**, 21, Cavendish Place, London, W.1 (telephone: Langham 9291), instead of the sales companies, which will cease to operate from that date. All dealership agreements and distribution arrangements now current will continue to be operated as hitherto by B.R.C. and accounts matters will be dealt with by B.R.C. at 270, Great Cambridge Road, Enfield (telephone: Enfield 5353).

Morganite Resistors, Ltd., and **Siemens Edison Swan, Ltd.**, have announced that by mutual consent they terminated arrangements on 31st December for the distribution of "Morganite" potentiometers and resistors. Continuity of supplies will be ensured by the Radio Resistor Co., Ltd., 50, Abbey Gardens, London, N.W.8, who will, as from today (Friday), handle all sales to wholesalers and retailers of Morganite Resistors, Ltd., products.

A. S. Duran & Co., Ltd., electrical wholesale distributors, Reading, have now opened a new branch in

Spa Road, Southampton. The new premises include a showroom and a trade counter. Mr. C. V. Burrows is manager of the branch.

Mr. A. G. Berry has joined the industrial sales force of **Mullard, Ltd.**, as representative for the area comprising Oxfordshire, Buckinghamshire, Middlesex and the London N.W. postal districts. He will be responsible in this area for liaison with capital equipment manufacturers and other users of the industrial products marketed by the Semiconductor Division, the Component Division and the Government and Industrial Valve Division of the company.

Calendars and Diaries

The calendar received from British Insulated Callender's Cables, Ltd., is mounted on a strong wall card and shows not only the preceding, current and following months, but also the years 1959, 1960 and 1961.

High Duty Alloys, Ltd., has sent us a neat pocket diary bound in navy blue soft leather which contains a number of pages of technical data relating to alloys which the company produces.

Some excellent coloured pictures of Swiss scenes adorn the monthly sheets of the calendar of Engelhard Industries, Ltd.

The desk calendar of Lec Refrigeration, Ltd., has weekly slips surmounted by the company's trade mark.

BRITISH AND RUSSIAN TRADE FAIRS

AN agreement on the holding of reciprocal exhibitions of Soviet and British trade and industry in London and Moscow respectively during 1961 has been signed in London. The agreement was signed by Mr. M. V. Nesterov, president of the All-Union Chamber of Commerce of the U.S.S.R., Mr. V. G. Sherren, managing director of Industrial & Trade Fairs, Ltd., organisers of the British Exhibition, and Mr. F. Bower, president of the Association of British Chambers of Commerce.

Mr. Nesterov and his colleagues, Mr. A. V. Saag, head of the Overseas Fairs Department of the A.U.C.C. and Mr. K. I. Smolyanov, head of the Department of the A.U.C.C. responsible for foreign exhibitions in Moscow, have been holding discussions with Industrial & Trade Fairs, Ltd., on all matters affecting the planning of the two exhibitions, which will be held under the joint sponsorship of the All-Union Chamber of Commerce and the Association of British Chambers of Commerce.

The Soviet Exhibition, which will occupy about 250,000 sq ft, will be held at Earls Court, London, from 7th to 29th July, 1961. The exhibits are expected to include both capital and consumer goods. There will also be

features depicting the achievements of Soviet industry, science and technology.

The British Exhibition will be held from 19th May to 4th June, 1961, in the Sokolniki Park of Culture and Rest, Moscow, and will make use of the Glass and Dome Pavilions, which were erected for the American Exhibition in Moscow earlier this year.

The scale of the response to this project from British industry has been so great that the covered space required by the British Exhibition will be considerably greater than that occupied by the American Exhibition. Temporary structures will therefore be erected on the Moscow site by Industrial & Trade Fairs, Ltd. It is expected that the total area of the British Exhibition will be about 250,000 sq ft.

Industrial & Trade Fairs, Ltd., intends as far as possible to sectionalise the exhibition, and to ensure a representative display of products in major industrial groups, such as machine tools, textile machinery, electrical and electronic equipment. The exchange of exhibitions has the active support of the British Government, and the Board of Trade will participate in the British Exhibition with a specially designed exhibit.

PERSONAL AND SOCIAL

News of Men and Women of the Industry

Changes in the boards of two of the electrical subsidiaries of the Metal Industries Group are announced. Because of indisposition which is likely to continue for some time, **Mr. J. H. Rawlings** has relinquished the position of managing director of Avo, Ltd. He is, however, remaining on the board of the company as deputy chairman, and also on the board of Brookhirst-Igranic, Ltd. **Mr. S. R. Wilkins** succeeds him as managing director of Avo, Ltd. **Mr. E. Strauss** has been appointed director and general manager of Taylor Electrical Instruments, Ltd., and has joined the Avo board. **Mr. Wilkins** has joined the board of Taylor's.

Mr. T. W. Heather has been re-elected chairman of the Electrical Fair Trading Council for 1959-60, and **Mr. A. E. Iliffe** has been re-elected vice-chairman. Both the chairman and vice-chairman have served in their respective offices continuously since 1956. **Mr. H. C. White** (Philips Electrical, Ltd.) has been appointed to represent the Electric Lamp Industry Council on the Electrical Fair Trading Council in place of **Mr. A. E. Page**.

As we briefly reported in our last issue, **Mr. H. Watson** retired from the position of manager of the Sutton Coldfield and North East Birmingham

construction and maintenance departments. In 1945 he became superintendent of the Northern Division of Birmingham and after the M.E.B. was formed, manager of the N.E. Birmingham District, with which the Sutton Coldfield District was amalgamated later.

Mr. Patterson, who is sixty, was educated at Camp Hill Grammar School and Birmingham University, and after service in the R.N.A.S. and the R.A.F. in the 1914-18 war spent the early part of his career with the Birmingham Electric Supply Department. Beginning as a switchboard attendant at Summer Lane generating station, he held progressive posts, including an appointment as the Birmingham industrial power engineer, until 1945, when he became superintendent of the Southern Division of Birmingham, later becoming manager of the S.W. Birmingham District of the M.E.B. **Mr. Patterson**, who is co-author of a standard work on transmission and distribution, has been a lecturer on electricity supply at Birmingham University and the College of Technology and at the E.D.A. conference in 1958 he presented a paper on electro-heat in industry. He is a former chairman of No. 7 Midland Centre of the Association of Managerial Electrical Executive and a member of the committee of the South Midland Centre of the I.E.E. and local hon. treasurer of its benevolent fund.

Mr. Smith joined the Birmingham Electric Supply Department as a trainee in 1935 and after service in the R.A.S.C. in the last war, in which he attained the rank of major, he held progressive posts until 1947, when he became Birmingham S.E. district engineer. He later served as district engineer of Birmingham N.W. District, as senior assistant engineer at Birmingham Sub-Area headquarters and as manager of the Sutton Coldfield District before becoming manager of the Birmingham S.E. District in 1955.

Mr. Rockcliffe, who was educated at Birmingham Central Grammar School and the Central Technical College, served his apprenticeship in

industry, joining the Birmingham Electric Supply Department in 1946 as a graduate trainee. Following nationalisation he held progressive posts on the engineering staff at Birmingham Sub-Area headquarters until February, 1955, when he became deputy sub-area engineer.

In our last issue we briefly reported the appointment of **Mr. A. E. Adamson**, Associate I.E.E., commercial engineer of the Wood Green District of the Eastern Electricity Board, as senior assistant commercial engineer at the Suffolk Sub-Area headquarters in succession to **Mr. H. B. Rendle**, who is now the Bury St. Edmunds 'district



Mr. A. E. Adamson

manager. **Mr. Adamson** received his technical training at Walthamstow Technical College and with the Northmet Power Co. and became a junior sales assistant for that organisation at Chingford in 1930. In 1935 he became the assistant sales engineer at Tottenham, a post which he held until 1943. He then joined the Navy and became a chief electrical air fitter, remaining in the service until 1946. Upon his release he was appointed district commercial engineer at Edmonton and in 1951 became commercial engineer for Southgate and Wood Green.

Mr. N. Haglov, previously manager of the Printing and Allied Trades Department of Fuller Electric, Ltd., will now act for the ASEA group of Sweden as their technical specialist in the United Kingdom for the graphic industry. He will continue to operate from the Fuller works address at Fulbourne Road, London, E.17. **Mr. J. W. Percy**, formerly engineer for special contracts, succeeds **Mr. Haglov** as manager of the Printing and Allied Trades Department and will be responsible for the commercial and engineering aspects of the department. **Mr. K. G. Draeger**, B.Sc., A.M.I.E.E., retains his position as deputy manager of the department.

The annual dinner of the Kelvin Works "25" Association was held recently, over 100 members, all with a minimum of twenty-five years' service with the **Hackbridge Holding Group** of companies, sitting down to dinner at the Carshalton Public Hall, Surrey. Following the dinner, the group chairman, **Mr. A. L. Foulger**, presented gold watches to twenty-five

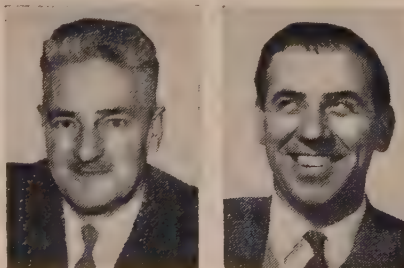


Mr. H. Watson

Mr. D. J. Smith

District of the Midlands Electricity Board at the end of the year, and he has been succeeded by **Mr. D. J. Smith**, T.D., M.I.E.E., manager of the Birmingham South East District. In February next **Mr. J. H. Patterson**, M.I.E.E., manager of Birmingham South West District, is retiring, and he is to be succeeded by **Mr. R. H. Rockcliffe**, A.M.I.E.E., deputy to the Birmingham sub-area engineer, **Mr. A. C. MacQueen**, M.I.E.E.

Mr. Watson has had fifty years in the electricity supply industry, beginning as a trainee with the Aston Manor Corporation Electricity Department in 1909 before Aston became part of Birmingham. He held progressive posts with the Birmingham Electric Supply Department, serving at Chester Street and Summer Lane generating stations and in the mains,



Mr. J. H. Patterson

Mr. R. H. Rockcliffe



Long service presentations to Hackbridge Cable Co. employees. Left to right: Mr. A. L. Foulger (Hackbridge Holding group chairman), Mr. P. Agnew, Mr. P. J. Agnew and Mr. E. W. Farr (director)

members who had each completed over forty years' service. The recipients included father and son, Mr. P. J. Agnew and Mr. P. Agnew, each with over forty years' service with the Hackbridge Cable Co. Assisting with this presentation was Mr. E. W. Farr (director), who had himself just received a watch.

Tube Investments, Ltd., announces the appointment of an executive board of its Electrical Division, of which **Mr. E. G. Plucknett** will be managing director. The board will be responsible for the policy of all companies in the Electrical Division, which includes the Simplex Electric Co., Ltd., Mersey Cable Works, Ltd., and the Power Centre Co., Ltd.

Mr. J. Mellanby, M.A., A.M.I.E.E., author of the article on "Earthing Practice" (page 15), was a technical officer with the Ministry of Supply during the war, and from 1948 to 1951 he was consultant engineer to the University College of Ibadan, Nigeria. Since then he has been building up his own business



Mr. J. Mellanby

as a technical agent, consultant and contractor in Ghana. Mr. Mellanby has been concerned with the electricity supply scheme for Aiyetoro, a fishing town on a coastal swamp, and also street lighting in Accra.

Mr. E. H. Blacker, LL.B., has been appointed accountant-secretary of the Central Gloucestershire Sub-Area of the Midlands Electricity Board in succession to **Mr. W. C. M. Hughes, A.C.A.**, who, as recently announced, has been appointed to a similar post at the North Staffs. Sub-Area headquarters. Mr. Blacker, whose new appointment takes effect from today (Friday), began his career with the

County of London Electric Supply Co., Ltd., and was chief clerk in the North East Area consumers' accounts department when the industry was nationalised in 1948. From 1948 to 1955 he held appointments as a principal assistant on the accounting staff of the Eastern Electricity Board, and in 1955 was awarded a Central Electricity Authority scholarship and became a full-time law student at London University. After obtaining a second-class honours degree in 1958 he returned to the staff of the Eastern Electricity Board as a principal assistant in the Board headquarters secretarial department. Since October last he has held a similar post at the Northmet Sub-Area headquarters.

Mr. A. H. Stafford, M.A., has been appointed secretary of the Eastern, London and South Eastern Region of the Central Electricity Generating Board. He was previously secretary of the London Division of the Board.

Mr. Stafford was educated at Sedbergh School and Emmanuel College, Cambridge. In 1934 he was articled to Mr. F. E. W. Howell, Town Clerk of Manchester, and admitted a solicitor in 1937. He continued with the Manchester Corporation until 1948 when he became secretary of the Eastern Division of the then British Electricity Authority and in March, 1959, secretary of the London Division.

The principal guest at the annual dinner and dance of the Southern Centre of the **Institution of Electrical Engineers** held at the Polygon Hotel, Southampton, was the Director-General of the Weapons Department at the Admiralty, Rear-Admiral Michael Le Fanu, D.S.C.

He was welcomed by the chairman, Mr. W. D. Mallison, who said that working within the Weapons Department under Rear-Admiral Le Fanu were about 200 members of the Institution. Other guests welcomed by Mr. Mallison included a vice-president of the I.E.E., Mr. C. T. Melling, C.B.E., Mr. E. Leete, hon. treasurer of the Institution, and officers representing the local associations of civil

and mechanical engineers. Mr. Melling responded to the toast to the Institution proposed by Rear-Admiral Le Fanu. Members attending the function included many from Southampton, Portsmouth and Bournemouth and from other places within the area covered by the Southern Centre.

Mr. R. C. G. Williams, Ph.D., B.Sc. (Eng.), A.C.G.I., D.I.C., M.I.Mech.E., M.I.E.E., chief engineer of Philips Electrical, Ltd., is among the distinguished scientists and engineers who form the board of the newly-created College of Technologists set up under the auspices of the National Council for Technological Awards. The College will administer and confer a new award, M.C.T. (Member of the College of Technologists), which is the technological equivalent of a university Ph.D., and a development of the Diploma in Technology. The M.C.T. award will be given to those who complete a substantial programme of work of value to industry, carried on jointly in industry and a college.

Mr. R. T. W. Anderson, D.F.H., M.I.E.E., has been appointed district



Mr. R. T. W. Anderson

manager at the Birmingham Works of British Electrical Repairs, Ltd. He received his technical training at Faraday House before joining E. Reader & Sons, Nottingham. After a period with the Croydon Corporation Electricity Department, he gained further electrical experience with companies in London and Manchester. During the war he served as an electrical officer, in the Royal Air Force, Bomber Command, with the rank of flight lieutenant. After the war he joined British Electrical Repairs, Ltd., as assistant district manager at the Cardiff Works and later became first manager of the Bath Works. Mr. Anderson has served on the Committee of the Western Centre of the Institution of Electrical Engineers and is a past-president of the Somerset Sub-Branch of the Association of Mining Electrical and Mechanical Engineers.

Mr. Anderson succeeds **Mr. J. Ashmore, M.I.E.E.**, Associate I.Mech.E., who is retiring after twenty-six years as district manager at the Birmingham Works. Mr. Ashmore is a past-chairman of the I.E.E., South Midland Centre, and is a fellow of the American I.E.E.

Mr. Bertie Gill, founder and ex-chairman and managing director of the Midland Dynamo Co., Leicester, recently received his portrait in oils from the staff and 200 workpeople. Mr. Gill retired from the firm in 1958. The portrait was executed by Mr. D. P. Carrington, head of the drawing

department of the Leicester College of Art. The presentation was made by Mr. R. Barnes, one of the firm's senior workpeople, who has been with the Midland Dynamo Co. for forty years.

Mr. G. W. T. King, assistant contracts manager, has been appointed contracts manager of Cable & Wireless, Ltd., with effect from 1st January, in succession to **Mr. R. C. F. Saxby**, who has retired. **Mr. S. W. Austin**, of the Contracts Department, has succeeded Mr. King as assistant contracts manager.

Mr. V. H. C. Phillips, director of Kent Bros. Electric Wire Co. & E. H. Phillips, Ltd., has been elected chairman of the Covered Conductors Association for the forthcoming year. **Mr. A. E. Shilling**, director of the London Electric Wire Co. & Smiths, Ltd., who was director and secretary of the Association until 1957, has been elected vice-chairman.

Mr. D. Wright, A.M.I.Mech.E., A.M.I.E.E., deputy superintendent of Brighton "A" and "B" power stations, has been appointed superintendent of the North Tees power station in the North Eastern Division of the C.E.G.B. Mr. Wright commenced his career as a student engineer with the Leeds Electricity

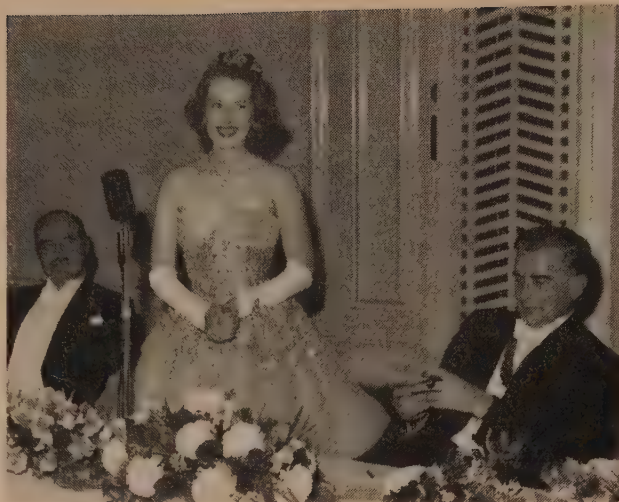


Mr. D. Wright

Department and in 1947 went to Meaford as assistant shift charge engineer. There followed appointments at Staythorpe as shift charge engineer, and at Littlebrook as operation and efficiency engineer before going to Brighton in 1956. During his time there he was seconded to Croydon "B" for nine months, where he was acting station superintendent. He takes up his new appointment today.

Mr. C. F. Kearton, O.B.E., has been appointed chairman of the Electricity Supply Research Council, in succession to **Sir David Brunt**. He has been a member of the Research Council since 1954 and takes up his new appointment today (Friday). Mr. Kearton is a part-time member of the United Kingdom Atomic Energy Authority and a director of Courtaulds, Ltd., and other textile companies. **Sir David Brunt** has accepted the appointment of vice-chairman of the Research Council.

Mr. David Moffat, M.B.E., of the Electricity Council, who has been chairman of the superannuation schemes for the electricity supply industry and has in addition undertaken special duties for the Council, retired from full-time service on 31st December. He is being retained, however, on a part-time basis, in particular as chairman of superannuation schemes. Before joining the British



The Viscountess Lewisham speaking, as guest of honour, at the A.S.E.E. ladies' evening at the Connaught Rooms, reported in our last issue. Also in the picture are (left) Sir Harold Bishop, C.B.E. (immediate past-president, deputising for the president, Sir Josiah Eccles, C.B.E.), and the chairman of the Association, Mr. C. G. Aldridge

Electricity Authority as director of establishments in 1947 he was in the Civil Service, being assistant secretary in the Establishments Division of the then Ministry of Fuel and Power. During this period he was loaned for three months to Lord Hindley to assist in the setting up of the National Coal Board.

Prof. R. E. Lane, C.B.E., Nuffield Professor of Occupational Health at the University of Manchester, has been appointed part-time medical adviser to the Electricity Council with effect from today (Friday). In this capacity Prof. Lane will also act as medical adviser to the National Joint Advisory Council and the superannuation schemes of the industry.

The annual dinner of **Wandleside Cable Works, Ltd.**, was held at the Dog and Fox Hotel, Wimbledon, on 22nd December. Mr. W. L. Wray, managing director, replying to the toast of the company proposed by Mr. A. A. Barger, referred to the "price politics" with which the cable industry had been inflicted and said that non-wire-drawing cable companies should obtain their copper either from non-cable-making copper rod rollers or from overseas. Mr. Wray went on to say that the company's products were well received in the U.S.A. and that some 50 per cent of the cable group's output was exported. He mentioned a number of additions to their range of high-temperature wires. Mr. T. G. Elliott proposed the toast of the guests, with a special mention of the ladies, and Mr. G. T. Wright responded.

Mr. J. E. Blair, chief accountant of the Eastern Electricity Board and the last of the original chief officers appointed when the industry was nationalised in 1948, retired at the end of the year. Born in Carlisle in 1894, Mr. Blair has been associated with the industry since 1914 when he joined the Northmet Electric Power Supply Co. as personal assistant to Capt. J. M. Donaldson. After service in the 1914-18 war he returned to the general manager's office of the

Northmet and in 1923 was placed in charge of the company's new central offices at New Southgate. In 1928 he was appointed accountant of the Northmet Power Co. and the Northmet Power Station Co. and in 1940, in addition to his accountancy duties, became the assistant secretary of these companies and the Bishop's Stortford Gas Co., becoming secretary and accountant of all three companies in 1947.

Mr. Kenneth Allen, chairman of the B.E.A.M.A. Council, recently made a presentation to **Col. B. H. Leeson** and Mrs. Leeson to mark Col. Leeson's retirement as director of B.E.A.M.A. Col. Leeson is remaining as consultant until the end of January. The gifts from B.E.A.M.A. members consisted of a television set and a diamond brooch.

The annual general meeting of the Tyne and Wear Area of the **Electrical Industries Benevolent Association** will be held on 14th January (3 p.m.), in the Lecture Theatre, Carlisle House, Newcastle-upon-Tyne, under the chairmanship of Mr. T. E. Dellow.

Mr. G. Barnard, A.M.I.E.E., who writes in this issue on "Inspection of Large Boilers" (page 8), was educated at Johnston Technical School, Durham, and Rutherford College, Newcastle. He was employed by Sir W. G. Armstrong, Whitworth & Co., Palmer's Steel Works and the Walter Scott



Mr. G. Barnard

Coal Co. before joining the National Boiler & Insurance Co. in 1924 as inspecting engineer. He became head of the Electrical Department and in 1951 was appointed overseer of all technical departments. After leaving the company early last year he worked as a freelance consultant before joining Norris Consultants, Ltd., as

manager for the Manchester and North Midlands area. Mr. Barnard also acted as lecturer and examiner at the Manchester College of Technology from 1933 to 1939.

Mr. J. H. Gordon, sales manager of the Wardle Engineering Co., Ltd., retired in December, after forty-five years with the company. He is succeeded by **Mr. C. Atkins**, whose appointment is effective from today (Friday).

Mr. W. G. Robinson, B.Sc.Tech., A.M.I.E.E., who writes in this issue on "Extra High Voltage Insulators" (page 3), studied electrical engineering at the College of Technology, Manchester. He joined Bullers, Ltd., in 1931 and has remained with the company since that time, becoming chief engineer in 1958. He has recently been appointed to the board of directors. Mr. Robinson serves on a number of British Standard and International Electro-technical Commission committees dealing with insulators and ceramic materials.



Mr. W. G. Robinson

OBITUARY

Mr. E. W. B. Gill.—The death occurred on 20th December, at the age of seventy-six, of Mr. Ernest Walter Brudenell Gill, O.B.E., B.Sc., M.A., Emeritus Fellow of Merton College, Oxford. After taking a first-class degree in physics at Oxford, Mr. Gill became a demonstrator in the Electrical Laboratory, a position which he held until 1949. During the 1914-18 war he served in the Royal Engineers (major) on wireless intelligence and in the last war was in the Royal Signals and was engaged in operational research. He served on the Oxford City Council as University representative from 1927 and was chairman of the Electricity Committee until the nationalisation of the undertaking in 1948 when he became deputy chairman of the Southern Electricity Consultative Council.

Mr. Gill published accounts of researches in a variety of subjects, including discharges through gases, radio, the magnetron and frictional electricity.

Mr. C. J. Chisholm, lighting engineer to the Sheffield Corporation, collapsed and died in a car on 22nd December on his way home from the Lord Mayor's Christmas Supper Party at the Town Hall, Sheffield. Mr. Chisholm was appointed lighting engineer of Sheffield in 1950 and was previously lighting engineer at Greenock for some years. He had also held a similar position at Stockport and was with the Glasgow Lighting Department for several years. In

Sheffield Mr. Chisholm was responsible for the change-over from filament to sodium street lighting and this work is still being carried out. The floodlighting of the Sheffield Town Hall was completed in time for the Lord Mayor's Christmas Party and this work was carried out under Mr. Chisholm's direction. He was a member of the Council of the Association of Public Lighting Engineers, a past-chairman of the Illuminating Engineering Society (Sheffield Centre) and a Fellow of the I.E.S.

Sir Hugh Mackenzie, C.B.E., deputy chairman of the North of Scotland Hydro-Electric Board, died on 24th

December at the age of seventy-one. He had been a member of the Board since its inception in 1943; his term of office as deputy chairman was to have expired on 31st December. He was a former Provost of Inverness.

Mr. T. Westwood, Glasgow branch representative of W. T. Henley's Telegraph Works Co., Ltd., died on 19th December at the age of fifty-six. He had been with Henley's for twenty-four years.

Mr. Horace Victor Ellis, a director of the City Electrical Co., died on 21st December at Chalfont Hospital in his sixty-third year.

Parliamentary Report

A DESCRIPTION of the proposed new submarine cable system—"Scotice"—linking the United Kingdom with the Faroes and Iceland was given by the Assistant Postmaster General (Miss Mervyn Pike) when the House of Commons approved the Post Office (United Kingdom-Iceland Cable) agreement. She said it was planned to complete the project before the end of 1961. The new cable would provide 24 channels for telephone conversations, each of which could be broken down to give 24 telegraphic circuits. Another new cable, linking Iceland with Greenland and Newfoundland, was planned for the end of 1962.

Britain would have a 50 per cent share of the cable between the U.K. and the Faroes and would own the cable station at Gairloch in Scotland. The Great Northern Telegraph Company of Denmark would have primary responsibility for the construction of the cable but all specifications and contracts would be approved by the Postmaster General. It was the intention that both the cable and the repeaters should be manufactured in Britain and that the cable should be laid by the British cable ship *Monarch*.

Lighting of Traffic Routes

Mr. Hay, Parliamentary Secretary, Ministry of Transport, said that an interim report had been received from the Consultative Committee on the Lighting of Traffic Routes within the London Conurbation. It contained valuable recommendations to the local lighting authorities on the improvement and co-ordination of their lighting and it was hoped the authorities would give careful consideration to the recommendations.

Cooling Tower Fault

Mr. Snow referred to the fault which had developed in a cooling tower of novel design at present being constructed by the Central Electricity Generating Board and asked the Minister of Power whether special provision was made for the possibility of frustrated expenditure when giving

capital sanction to projects of this nature. Mr. Wood replied that major construction projects of the C.E.G.B. were carried out by contracting firms which were responsible for correcting faults such as this one. No special provision was needed, therefore, in the Board's capital investment programme.

Training Facilities in Rhodesia

Mr. Amery, Under Secretary, Colonial Office, replying to a question by Mr. Pargiter, said that two African learner electricians and two trade tested African electricians had been sent to Victoria Falls earlier this year for training as shift attendants. They would be posted in that capacity to one of the new hydro-electric stations being built in the Northern Province. Other Africans would receive similar training when suitable recruits came forward.

Push-button Telephones

In reply to Mr. Cronin, the Postmaster General (Mr. Bevins) said the possibilities of the push-button type of telephone were being studied in conjunction with the use of electronic switching. He agreed that push-buttons were quicker to operate than dials but said that, with the present electro-mechanical switching system, their use would not speed up the time for connecting calls and would necessitate the provision of additional equipment at the telephone exchange, so increasing costs.

During the third reading of the Post Office and Telegraph (Money) Bill in the House of Lords, Lord Chesham said that ten years ago the waiting list for telephones was nearly 500,000. Today the actual waiting list was 50,000 and the majority of these would get their telephones within a year. The Post Office was connecting new customers at the rate of more than 1,000 a day.

Atomic Energy Authority Bill

The Atomic Energy Authority Bill was read the third time in the Lords and passed.

Financial Section

STOCKS and SHARES

IN the closing stages of 1959 the industrial markets of the Stock Exchange were maintaining their form in great style. Further strong advances took the index of leading industrial share prices to points more than 45 per cent above those ruling twelve months earlier. For the latest upward surge, credit was given partly to the reports of record Christmas spending in the shops and partly—perhaps more importantly—to first disclosures of Government intentions in connection with the amendment of laws affecting the investment powers of trustees. Investors were quick to draw inferences from the possibility of changes which might permit the introduction of equities into funds at present confined to gilt-edged securities. For the latter, these considerations could do nothing to help the market out of its depression.

Higher Prices

During the fortnight covering the Christmas holiday the many, and often substantial, gains in prices were well distributed throughout the industrial share lists. Within the general movement there was a marked improvement in the demand for investments in the capital industries. The shares of Head Wrightson, International Combustion, Richardsons Westgarth and Tube Investments were in the van of an advance by the heavy brigades. Of shares in the major electrical groups, English Electric were again strongly supported, up to 51s, and the rise in B.I.C.C. continued to 59s. At the same time the lighter engineering shares also recorded numerous good improvements, including those in Hoover, which crossed the £5 mark, Decca, Bulpitts, Thorn Electrical, Plessey, Cossor, Ever Ready and others. E.M.I. at 54s were marked ex- the 50 per cent scrip issue. Dealings in Dimplex 5s shares have been taking place at prices about 11s above the figure of 19s at which the recent public issue attracted overwhelming subscriptions.

Bid for Lancashire Dynamo

The £1 shares of Lancashire Dynamo Holdings were marked up from 48s 9d to 65s as a first reaction to the news, announced on Christmas Eve, of a bid from Metal Industries. With the latter company's shares at 74s 6d, the offer of four of these, plus 30s cash, for every five of Lancashire Dynamo is worth about 65s 9d per L.D. share (excluding dividends), and altogether nearly £10 million for the whole of the company's share capital (including the preference, for which there is also a share-exchange proposal). At this stage, the offer has

been communicated to the L.D. board with a request that it shall be passed on to shareholders. It will be conditional upon acceptances by at least 90 per cent of shareholders, and upon approval by members of Metal In-

dustries to the necessary increase in capital.

Company News

Burco Dean 5s shares have been quoted lower at 16s 6d since the

Price Changes in

Company or Board	Nom. Value	Middle price 28th Dec.	Two Weeks' Rise or Fall	Dividend		Yield %	1959	
				Pre- vious	Last		High- est	Low- est
Gilt-edged Stocks						£ s d		
Brit. Elec. 1968/73	100	79	-1	3	3	3 16 0	81	77½
Brit. Elec. 1974/77	100	76	-1	3	3	3 19 0	78	74½
Brit. Elec. 1976/79	100	79½	-1	3½	3½	4 8 0	81	77½
Brit. Elec. 1974/79	100	90	-1	4½	4½	4 14 6	91½	87½
Overseas Electric Supply								
Calcutta Elec.	£1	19/6	-6d	6-8†	7†	11 9 6	20/-	16/-
East African Power	£1	20/-		7½	8	8 0 0	22/6	19/3
Nigerian Elec.	£1	18/-	+1/-	8	8	8 18 0	18/-	13/-
Perak Hydro-Elec.	£1	17/-	+2/6	10	5	5 17 9	17/-	12/3
Electrical Shares								
Aberdare Holdings	5/-	17/9		17½	17½	4 18 6	18/9	15/6
Aerialite	1/-	8/9	+6d	54	54	6 3 6	12/3	7/9
Allen, W. H.	£1	56/3		11	12	4 5 6	56/3	43/-
Allied Insulators	5/-	23/-	-6d	—	20†	4 7 0	23/6	18/9
Anglo-Portuguese Tel.	£1	29/-		9	9	6 4 3	30/9	26/6
Aron Elec. Ord.	£1	45/-		15	15	6 13 3	62/6	45/-
Assoc. Elec. Ord.	£1	60/6	+6d	15	15	4 19 3	67/-	53/9
Automatic Tel. & El.	5/-	21/3		17	17†	4 0 0	21/3	18/-
Babcock & Wilcox	£1	46/6	+1/-	13½	13	5 11 9	52/6	43/-
Bakelite	10/-	39/-	+6d	15	15	3 17 0	40/-	22/-
Baldwin, H. J.	2/-	2/3	-3d	20	—	—	3/-	2/-
Berry's Electric	5/-	32/6	-9d	10	20½*	3 1 6	33/6	7/3
Bowthorpe Holdings	2/-	10/6	+6d	25	27	3 2 0*	10/9	8/-
British Elec. Traction:								
Def. Ord. "A"	5/-	47/6	+3/-	25	35	3 13 9	47/6	35/6
B.I. Callender's	£1	59/-	+2/6	12½	13½	4 11 6	59/-	44/9
B.I. Callender's 6% Pref.	£1	21/-		6	6	5 14 3	21/-	19/9
British Thermostat	5/-	23/-	+6d	30	35	3 16 3*	28/-	18/6
British Vac. Cleaner	5/-	11/3		10	7½*	3 6 9	12/6	4/6
Brook Motors	10/-	57/6	+1/-	25	25*	4 7 0	59/6	46/-
Bulgin, A. F.	1/-	13/9	+1/-	45	50	3 12 9	13/9	6/9
Bulpitts	5/-	20/6	+1/-	—	15	3 13 3	20/6	10/-
Burco Dean	5/-	16/6	-3/-	16	18	5 9 0	19/6	12/3
Cable & Wireless:								
Ord.	5/-	18/9	+1/-	10	10*	2 13 3	19/-	12/3
4% Loan	100	96	+2	4	4	4 3 3	96	93
Chloride El. Storage "A"	£1	69/-	+4/-	17½	20†	3 17 0*	72/-	43/8
Clarke Chapman	£1	55/-		27½	13½*	5 0 0	66/3	52/6
Cole, E. K...	5/-	27/6	+1/-	17½	20	3 12 9	27/6	17/3
Contact Switchgear	5/-	15/6	+9d	14	14	4 10 3	16/9	12/-
Cossor, A. C.	5/-	9/3	+2/-	Nil	5	2 14 0	9/6	6/3
Crabtree	10/-	54/-		20	20	3 14 0	54/-	28/-
Crompton Parkinson	5/-	17/6		12	14	4 0 0	19/-	11/9
Davis & Timmins	5/-	21/9		18	20	4 12 0	22/-	14/6
De La Rue	10/-	69/6	+2/-	17½	20	2 17 6	70/-	30/3
Decca "A"	10/-	50/6	+3/-	50	20*	3 19 3	50/6	33/3
Desoutter	5/-	37/6	+6d	25	21½*	2 18 0	37/6	19/-
Dewhurst	2/-	9/-	-6d	20	20	4 9 0	9/6	7/3
Dictograph Tel.	2/-	11/9	+3d	20	20	3 8 0	11/9	7/-
Dubilier Condenser	1/-	5/3		20	25	4 15 3	5/6	3/3
Duport	5/-	27/3	+3/9	12½	17½	3 4 3	27/3	10/3
E.M.I.	10/-	54/-x.c.		20	14*†	2 11 9	56/6	31/6
Electrical Apparatus	5/-	14/3	+3d	14½	14½	5 1 9	16/6	13/-
Electrical Components	5/-	12/6	-9d	12½	15	4 0 0*	14/-	7/-
Elec. Construction	£1	36/-	+1/-	8½	9	5 0 0	37/-	27/9
Elliott-Automation	5/-	26/3		—	11-2†	2 2 9	30/6	16/9
Enfield Rolling Mills	£1	57/-	+2/3	12½	15	5 5 3	60/-	36/9
English Electric	£1	51/-	+5/3	14	14	3 13 0*	51/-	37/10
English Electric 3½% Pref.	£1	13/6		3½	3½	5 11 0	13/6	12/3
Ericsson Tel.	5/-	26/3	+9d	12†	13†	4 1 0	28/-	22/3
Ever Ready	5/-	27/6	+2/6	20	27½†	3 0 0*	28/-	13/3
Falk Stadelmann	£1	35/-		10	10	5 14 3	35/6	25/-

The above quotations are based upon middle prices in the Stock Exchange Daily Official List.

* After scrip issue.

† Free of income tax.

‡ Dividend indicated.

announcement of the annual results, for although these included news of increases in both profits and the dividend, they were accompanied by advices to the effect that profits in the current year had been running at a rate much

lower than that of a year earlier. Sales of some of the group's domestic appliances were said to have contracted, but the directors felt that the expected reduction in the coming year's profits would prove to be temporary. The 5s

shares show a yield of about $5\frac{1}{2}$ per cent on the dividend as increased from 16 to 18 per cent. Dewhurst & Partner's 2s shares have also been a little reactionary, at 9s, following the preliminary statement of the results. Net profits were below the previous year's level, but they still cover practically $2\frac{1}{2}$ times over the amount of the ordinary dividend, which is being maintained at 20 per cent.

Electrical Investments

Company or Board	Nom. Value	Two Weeks' Middle Rise price or Fall		Dividend		Yield %	1959		
		28th Dec.	or Fall	Pre-vious	Last		High-est	Low-est	
Electrical Shares—continued							£	s	d
G.E.C. ...	£1	43/3	+3d	10	10	4 12 6	48/-	31/3	
G.E.C. 6½% Pref. ...	£1	23/-		6½	6½	5 13 0	23/-	20/3	
General Cables ...	5/-	9/-		24	15	8 6 9	9/3	7/6	
Greenwood & Batley ...	£1	116/3		20	20	5 3 3	117/6	75/-	
Hackbridge Holdings ...	5/-	16/3		20	20	6 3 0	19/3	14/3	
Hackbridge & Hewittic ...	5/-	13/9	—6d	20	20	5 9 0*	15/6	10/6	
Head Wrightson ...	5/-	28/6	+3/6	20	14½*	2 9 3	28/6	16/6	
Heatrae ...	2/-	9/6		20	20	4 4 3	10/-	7/6	
Holophane ...	5/-	18/9		22½	26	6 18 9	20/-	14/9	
Hoover ...	5/-	103/9	+8/3	50	60	2 17 9	103/9	55/-	
I.C.I. ...	£1	60/-	+3/6	12	8*	2 13 3	60/-	33/-	
Intl. Combustion ...	5/-	42/-	+3/3	25	30½	3 11 6	42/-	29/9	
Intl. Computers & T. ...	£1	74/3	+3/-	—	10	2 13 9	78/9	57/6	
Johnson & Phillips ...	£1	18/9		5	5	5 6 9	30/6	18/3	
Lancashire Dynamo ...	£1	65/-	+20/9	11	12½†	—	65/-	31/6	
Laurence Scott ...	5/-	18/-		15	15	3 11 6*	18/9	14/-	
Lister, R. A. ...	£1	55/6		12½	14	5 0 9	55/6	32/9	
Lucas, J. ...	£1	78/6	+8/-	10	12½	3 3 9	78/6	43/3	
Marconi Marine ...	£1	43/-	+1/-	10	10	4 13 0	48/6	40/-	
Marryat & Scott ...	2/-	14/3	+1/-	37½	22½*	3 3 3	14/3	8/6	
Mather & Platt ...	£1	52/-	+1/-	15	10½*	4 2 0	52/-	41/3	
Metal Industries ...	£1	74/6	+5/-	14	15½	4 0 6	74/6	39/9	
Midland Elec. Mfg. ...	£1	51/9	+6d	12½	10*	3 17 3	51/9	41/6	
Morphy-Richards ...	4/-	33/3	+6d	20	25	3 0 3	34/-	18/-	
Murex ...	£1	74/-	+10/-	17½	15	4 1 0	74/6	42/-	
Newman Ind. ...	2/-	3/6		10	10	5 14 3	3/6	2/3	
Oldham & Son ...	1/-	2/9		17½	17½	6 7 3	3/3	2/6	
Parsons, C. A. ...	£1	55/-		7½	8½†	2 19 0	58/-	45/9	
Philips' Lamps ...	Fl.10	157/6	—1/3	14	14	1 13 3	160/-	88/-	
Plessey ...	10/-	47/6	+2/6	20	14*†	2 19 0	47/6	23/6	
Pye ...	5/-	19/-	+9d	12½	12½*†	3 5 9	20/6	13/-	
Pyrotex ...	5/-	44/9		—	34	3 16 0	47/6	33/9	
Radiation ...	£1	40/-	+6d	5	6	3 0 0	40/-	24/9	
Reliance Clifton ...	5/-	22/6		15	15	3 6 9	24/6	17/6	
Reyrolle ...	£1	95/-	—6d	17½	17½	3 13 9	98/-	85/9	
Rheostatic ...	4/-	18/3	+3/3	12½	20½	4 7 9	18/3	8/3	
Richardsons Westgarth ...	10/-	14/3	+2/-	8½	8½	5 17 0	15/3	11/6	
Simon-Carves ...	5/-	35/-	+1/6	25	25	3 11 6	35/-	28/6	
Smith (England), S. ...	4/-	19/6	+1/3	12½	17½	3 11 9	21/-	11/6	
Southern Areas ...	£1	14/-	—6d	Nil	Nil	Nil	15/-	10/6	
Strand Elec. ...	5/-	17/9		15	20	5 12 9	18/-	8/6	
Sturtevant ...	5/-	22/-	—6d	15½	15½	5 10 0	23/6	17/-	
Sun Elec. ...	5/-	15/9		25	15*	4 15 3	16/9	8/3	
Switchgear & Cowans ...	5/-	15/6		22½	15*	4 16 9	16/-	10/3	
T.C.C. ...	10/-	57/6		25	25	4 7 0	58/6	38/-	
Telephone Mfg. ...	5/-	7/-	+9d	10	10	7 2 9	7/3	4/9	
Telephone Rentals ...	5/-	19/3	+3d	12½	12½*	3 5 0	22/6	11/9	
Thompson (John) ...	5/-	23/-	+1/6	25	25	5 8 9	25/6	19/6	
Thorn Elec. ...	5/-	56/3	+7/6	17½	20	1 15 6	56/3	26/3	
Thornycroft ...	£1	28/6		7½	6	4 4 3	30/-	20/6	
Tube Investments... ..	£1	134/6	+7/-	17½	20	2 19 6	134/6	71/6	
Vactric ...	5/-	43/-		25	37½	4 7 3	46/6	26/3	
Veritys ...	5/-	1/6		2½	—	—	5/-	1/3	
Walsall Conduits ...	4/-	14/9		22½	22½	3 9 3*	15/3	10/8	
Ward & Goldstone ...	5/-	57/6	+2/-	25	30	2 12 3	57/6	30/6	
Watford ...	2/-	11/6		25	25*	4 7 0	14/9	7/6	
Westinghouse ...	£1	58/-	+2/-	10	10	3 9 0	58/-	39/6	
West, Allen ...	5/-	14/6	+9d	12½	11½*	4 0 6	14/6	11/9	
Wolf Electric ...	5/-	10/6	+1/-	10	10	4 15 3	10/6	7/9	

I.C.T. Results

Financial results published recently by International Computers & Tabulators were the first to appear since the company was formed to effect the merger between British Tabulating Machine and Powers-Samas. They include a full year's contribution from B.T.M. but only nine months' earnings of Powers-Samas, so that there is no strict relation to previous results. Nevertheless a clearly favourable comparison was seen between the group profits of £2.3 million (before tax) for 1958-59 and the figure of just over £2 million representing the combined earnings of the two constituent companies in their last complete years before the union. There was satisfaction also in the market with the declaration of a 10 per cent dividend. Previously, the directors had forecast some increase in profits and a distribution of not less than 8 per cent, together with indications of a conservative dividend policy.

Dividends Declared

Among recent dividend announcements, the forecast of a final dividend of 14 per cent by the Rheostatic company was particularly well received; having already advanced steadily in previous weeks, the price of the 4s shares was subsequently marked up in the market by a further 3s 3d to 18s 3d. Against the total distribution of 12½ per cent for 1958-59, the directors' forecast indicates a total payment of 20 per cent for the year ended last September, at which rate the yield on the shares rises to nearly 4½ per cent. Profits are estimated to have improved by about 35 per cent on the 1957-58 figures. Murex £1 shares also reacted well to good dividend news in the form of an increase in the current year's interim payment to 7½ per cent, or 2½ per cent more than the rate to which it was cut a year ago. A statement from the company reported that on present indications the results for the twelve months ending next April would show a marked improvement on those of 1958-59. Since the announcement the price of the £1 shares has been advanced by some 10s, to 74s.

In our last issue it was incorrectly stated, in referring to the cable manufacturing section of the electrical market, that the London Electric Wire Co. & Smiths, Ltd., had been absorbed by the B.I.C.C. The L.E.W. was, of course, absorbed by Associated Electrical Industries, Ltd.

REPORTS and DIVIDENDS

Metal Industries and Lancashire Dynamo.—It was announced last week that Metal Industries, Ltd., had made an offer for the share capital of Lancashire Dynamo Holdings, Ltd. For the ordinary stock it is proposed to give £4 of new Metal Industries stock and 30s in cash for each £5 of Lancashire Dynamo stock and for each £5 of Lancashire Dynamo 5½ per cent preference stock the offer is £6 new 5 per cent Metal Industries preference shares. Explaining the reasons for the offer, Sir Charles Westlake, chairman of Metal Industries, said that it was in consonance with his policy of extending his group's activities in the engineering industries rather than in its traditional field of metals. If the offer is accepted the holders of Lancashire Dynamo ordinary stock will receive a dividend of 10 per cent to cover the period ending in March.

The offer for both classes of stock is subject to acceptance by not less than 90 per cent by value of the holders of each class and to the necessary approval being given by members of Metal Industries to the increase in the authorised capital. The offer envisages that the chairman and deputy chairman of Lancashire Dynamo Holdings will join the board of Metal Industries, while the chairman and deputy chairman of Metal Industries will join the board of Lancashire Dynamo Holdings. No other changes are at present contemplated. Assurances are given in regard to employees and preservation of pension rights. The value of the offer is estimated at around £9¼ million.

The Lancashire Dynamo Group consists of the following companies:—Lancashire Dynamo Holdings, Ltd., Lancashire Dynamo & Crypto, Ltd., Lancashire Dynamo Nevelin, Ltd., Lancashire Dynamo Electronic Products, Ltd., Lancashire Dynamo South Africa (Pty.), Ltd., Lancashire Dynamo Central Africa (Pvt.), Ltd., Lancashire Dynamo Group Sales, Ltd., Foster Transformers, Ltd., Foster Electrical Supplies, Ltd.; J. G. Statter & Co., Ltd., Minerva Mouldings, Ltd., Godfrey Electrical Industries (Pty.), Ltd., Crypton Equipment, Ltd., Crypto, Ltd., Dynamo & Motor Repairs, Ltd., Malcolm & Allan (London), Ltd., and the International Rectifier Co. (Great Britain), Ltd. Associated companies are:—Bepco Canada, Ltd., African Electrical Manufacturers (Pty.), Ltd., and Lancashire Dynamo Coates Pty., Ltd.

The British Electric Resistance Co., Ltd., held its annual meeting on 21st December, Mr. E. Hatton Miller (vice-chairman) presiding in the absence of the chairman and managing director, Mr. H. P. Huhne, who is on a visit to Canada and the United States.

In his statement, which had

previously been circulated to shareholders, the chairman said that the additional cost arising out of the national wages award of 1958 had been almost absorbed by the additional profits arising as a result of the increased turnover.

In the manufacture of resistances the parent company were faced with keen competition. They were doing all they could to meet this by technical research in the development of new lines, by improvement in manufacturing techniques and by extending their field of operations. They, with an American company, had acquired an interest in a Canadian company.

With regard to the subsidiary company, the British Power Transformer Co., Ltd., their policy over the last few years had been to specialise in the manufacture of variable transformers and voltage stabilising equipment and to replace their manufacturing capacity for orthodox power transformers with these new lines, sales of which were showing a steady increase.

The arrangements made in Australia had already brought about a satisfactory increase in sales there. In India the present import regulations had severely affected their exports and they were negotiating with their agents a licensing agreement whereby certain products would be manufactured in India to their specifications on a royalty or similar basis.

The turnover last year was again a record and the sales figures for the current year to date indicated that a further increase would occur; the order book at present carried a higher total than was the case twelve months ago.

The Rheostatic Co., Ltd.—The directors state that they expect to pay a final dividend of 14 per cent for the year ended 30th September last. Preliminary figures for the year indicate that profits are likely to show an increase over the previous year of approximately 35 per cent. A final dividend of 14 per cent would make a total of 20 per cent for the year (against 12½ per cent).

J. H. Fenner & Co. (Holdings), Ltd.—The group trading profit for the year ended 31st August last amounted to £599,936, as compared with £486,118 for the preceding year, and after meeting all charges, including £342,966 for taxation, the net balance is £236,970 (against £226,055). It is proposed to pay an ordinary dividend for the year of 15 per cent (unchanged) and to carry forward £500,735 (against £557,623 brought in).

In their joint statement, Mr. C. Bradshaw (chairman) and Mr. S. B. Hainsworth (managing director and deputy chairman) mention that the business of J. H. Fenner & Co., Ltd., in mechanical power transmission equipment continues to expand. During the year more types of special

V-belts have been added to the range, and two new products have been introduced, the "Flex-Link" adjustable V-belt and "Fenner Dodge" ball bearing plunger blocks.

Dealing with the associated companies, the statement says that N.G.N. Electrical, Ltd., manufacturing high vacuum equipment, has had an improved year in its new home at Accrington, and its scientific and technical staff is being enlarged.

Hackbridge Holdings, Ltd., has announced an interim dividend of 7½ per cent (unchanged).

The Lightfoot Refrigeration Co., Ltd., is paying an interim dividend of 3 per cent (unchanged).

W. H. Allen, Sons & Co., Ltd., have declared an interim dividend of 2½ per cent (unchanged).

The Ebonite Container Co., Ltd., is paying an interim dividend of 10 per cent (unchanged).

New Companies

Morphy-Richards (Sales and Services), Ltd.—Registered 15th December. Capital £100. To carry on the business of selling, dealing, repairing and servicing agents in all kinds of goods, equipment and apparatus, manufacturers of and dealers in electrical, gas, radio and television equipment, etc. Directors: D. W. Morphy and C. F. P. Richards. Regd. office: St. Mary Cray, Kent.

Maurice A. Harris, Ltd.—Registered 10th December. Capital £2,000. General electricians, etc. Directors: M. A. Harris, D. G. Mitchell and J. Harney. Regd. office: 141, Streatham High Road, S.W.16.

J. A. Keig, Ltd.—Registered 14th December. Capital £2,000. Manufacturers of and dealers in electrical equipment and accessories of all kinds, etc. Directors: J. A. Keig and Mrs. Margaret E. T. Keig. Regd. office: 71, Princes Street, Bishop Auckland, Co. Durham.

A.T.V. (Equipment), Ltd.—Registered 14th December. Capital £100. Manufacturers of and dealers in electrical, electronic, radionic, telephonic and photographic equipment, etc. Solicitors: Bartlett & Gluckstein, 199, Piccadilly, W.1.

Troxel Agencies, Ltd.—Registered 10th December. Capital £2,000. Suppliers and manufacturers of switchgear, relays, instruments, etc. Directors: D. J. Hopley, F. J. Hopley and W. B. Browne. Regd. office: 28, Kennedy Street, Manchester, 2.

Bristol Electrical Distributors, Ltd.—Registered 10th December. Capital £100. Importers, exporters, distributors and manufacturers of and dealers in electronic, radio, radar, television and scientific instruments and accessories, etc. Directors: G. J. Claremont, E. Gee, E. Benjamin and C. Z. Berger. Regd. office: 57, Blandford Street, W.1.

Bankruptcies

N. G. Morgan, 28, Major Road, Canton, Cardiff, electrician.—First and final dividend of 20s in the £, together with 4 per cent statutory interest, payable at the office of the Official Receiver, Board of Trade, County Court Buildings (1st Floor), Westgate Street, Cardiff.

G. G. Brittain, 1, Bromley Common, Bromley, Kent, radio and television electrical engineer and retailer.—First and final dividend of 11½d in the £, payable on and after 8th January at the offices of the Trustee, Walter House, 418-422, Strand, London, W.C.2.

Liquidation

Sarum Electric, Ltd.—Meeting of members on 19th January at 4, Mill Road, Southampton, to receive an account of the winding-up by the liquidator, Mr. D. W. Malpas.

Domestic Refrigerators

INCREASED capacity, larger and colder frozen food compartments, more shelf space and re-styled exteriors are some of the features included in the new range of refrigerators available from the FRIGIDAIRE DIVISION of GENERAL MOTORS, LTD., Stag Lane, Kingsbury, N.W.9.

The smallest model, the MA-34T (3.4 cu ft), is only 21in square by 36in high but its shelf area is increased to 7.7 sq ft. The freezer, in addition to storing nearly 7 lb of frozen food, now also contains a separate ice cube compartment. Shelving, as in all the new Frigidaire models, is adjustable and all shelves have an anodised golden front trim. Light blue and dark green have been chosen for the interior and there is a choice of five exterior colours—red, pink, green, cream, or white. The MA-45T model (4.5 cu ft) has a freezer capable of accommodating nearly 8 lb of frozen food, while the DA-46T de-luxe model (4.6 cu ft) is now capable of storing frozen food for three to six months. All these models are suitable for building in.

The MZ-84 model (8.3 cu ft), with adjustable shelving, full-width "Hydrator" and a butter compartment in the door store, provides a total shelf area of 15.9 sq ft and its frozen food capacity is 12.9 lb. The DZ-84 de-luxe model (8.4 cu ft) now accommodates 46½ lb of frozen food and, like the MZ-84, is sold in a choice of five exterior colours.

The remaining two refrigerators in the range are the MZ-101 (9.9 cu ft) and the DZ-101 de-luxe model (10.1 cu ft). These, and all the other models in the range, are fitted with the "Meter-Miser" rotary compressor. The prices, including purchase tax, are:—MA-34T, 55 gns.; MA-45T, 65 gns.; DA-46T, 72 gns.; MZ-84, 113 gns.; DZ-84, 125 gns.; MZ-101, 145 gns.; DZ-101, 158 gns.

The new "Main 24" refrigerator, just introduced by R. & A. MAIN, LTD. (ELECTRICAL DIVISION), 48, Grosvenor Gardens, S.W.1, is similar in many respects to its predecessor, the "Main 22." It is an absorption type model with a capacity of 2.4 cu ft and a shelf area of 5.4 sq ft. The cabinet, which has a flat top, measures 36in high by 21in wide by 21in deep. The cabinet liner is a one-piece plastic forming and is provided with five sets of shelf runners, enabling the three full-width shelves to be positioned as desired. The inside of the door has also been utilised to provide additional storage space in the form of an egg rack and two shelves. The ice-making compartment of the refrigerator is equipped with two 10-cube ice trays and, with the ice trays removed, can also be used to store up to 2½ lb of frozen food. The refrigerator is available with either a white or cream cabinet, with red trims on the door and with light-blue interior and

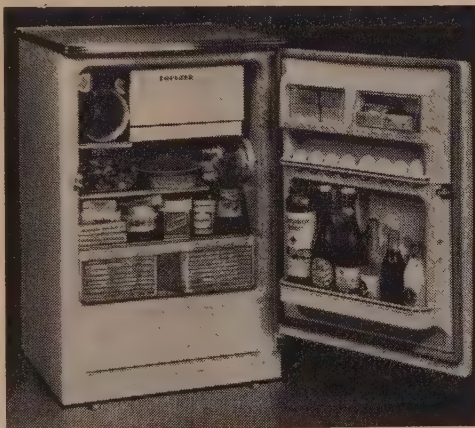
fittings. The press-button type door handle is finished in chromium plate. The price, including purchase tax, is £43 16s.

Several additions and changes in the range of "Everest" refrigerators have been announced by MERSEYSIDE ENGINEERING (REFRIGERATION), LTD., 14-20, South Castle Street, Liverpool, 1. Two new models are included, the "Everest 375" and "Everest 435," with capacities of 3.75 and 4.35 cu ft respectively. Both models have steel cabinets, with plastic interiors, and heat-resisting table-tops. They are also fitted with plastic feet at the front and rollers at the back. The measurements are 36in high by 22in wide by 23in ("375") and 24½in ("435") deep, and each is driven by a "Tecumseh" compressor. The prices, including purchase tax, are 58 gns ("375") and 68 gns ("435").

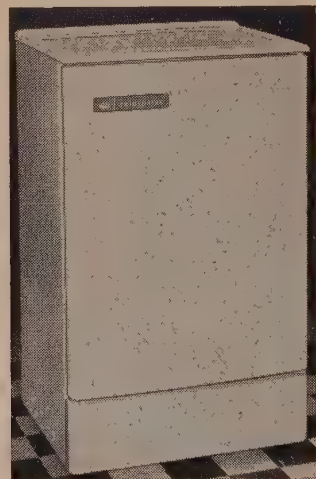
The capacity of the "Everest 390" refrigerator has been increased to 4 cu ft without increase in price. It is also announced that a new all-

British "Everest" refrigerator of 5.35 cu ft capacity is to be introduced shortly. The "Everest 250" absorption type model will be discontinued.

The latest "Prestcold" domestic refrigerator is the D.432 "Big Four." Among the many points of merit claimed for this model by the manufacturers, the PRESSED STEEL CO., LTD., Cowley, Oxford, are concealed wheels, making for easier movement; maximum food storage space; and extra-wide frozen food locker. The inner side of the door has a full-width dairy produce compartment, two shelves, and a wide shelf which is deep enough to carry pint-sized milk bottles. The cabinet interior is of porcelain enamel and there is an automatic interior light. The exterior of the refrigerator is finished in white or cream, and the table tops, with spill guards, are available in red, green, cream, blue or white. It is fitted with the "Presmetic" sealed compressor unit and the price, including purchase tax, is £70 12s 6d.

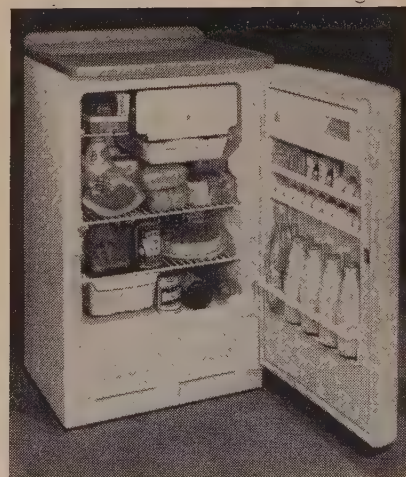


1. Merseyside Engineering Co.'s "Everest 375" refrigerator



2. The clean lines of this new model MZ-34T Frigidaire refrigerator are repeated for other models in the range. The Frigidaire insignia is incorporated in the door handle as illustrated

3. Prestcold D.432 "Big Four" refrigerator



DOMESTIC ELECTRICAL EQUIPMENT

DRY SHAVERS

ENTHUSIASTIC users of electric dry shavers agree unanimously that dry shaving is faster and a much more convenient method of shaving than with the aid of soap, water and brush. On the other hand, there are those who feel that the really ideal dry shaver has yet to be produced. It is not, however, our intention to take sides in this matter—the object of this survey is to indicate the range of models that are available. Just over a dozen companies now either manufacture or distribute dry shavers, several producing more than one type, and among these a model should be found to suit the most fastidious user.

For those who favour a rotary action, Philips Electrical offer the "Philishave Jet" with twin rotary cutters, while

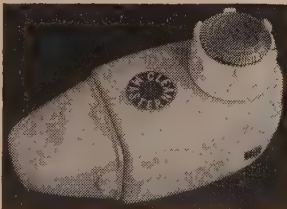
the latest "New Remington" has three twin shaving heads and roller combs. Self-adjusting rollers are also features of the new Sunbeam "Rollmaster" shavers, although for their "Shavemaster" models the use of a double-edged oscillating cutter is still favoured.

Dry shavers driven by a vibrator type movement can be used on a.c. supplies only, but other types, usually more expensive, are fitted with impulse motors and can be operated from either a.c. or d.c. supplies and cover voltage ranges between 100 and 250.

In addition, more especially for car owners and travellers, there are battery-operated models and re-chargeable types which need to be plugged into a mains socket outlet only once a week or ten days.

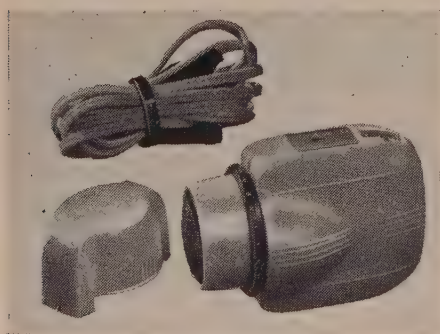
Manufacturer or Distributor	Name or Model	Type	Weight	Voltage Range	Special Features	Finish	Price (excl. tax)	Purchase Tax
CHILTON ELECTRIC PRODUCTS, LTD., Hungerford, Berks.	"Sportsman"	Vibrator	8 oz	220/240 a.c.	Extra-wide shim head, quiet action	Chestnut brown and cream and matching case	£3 14 8	£0 13 8
EVER READY CO. (GT. BRITAIN), LTD., Hercules Place, Holloway, N.7.	"Figaro I" De Luxe	Vibrator	12½ oz	100/125 and 200/250 a.c.	Snap-up trimmer, on/off switch, two interchangeable foils	Cream moulded body. In presentation case. Separate travel wrap	£8 18 10	£1 11 2
	"Figaro II"	Vibrator	12½ oz	100/125 and 200/250 a.c.	Snap-up trimmer, on/off switch, two interchangeable foils	Cream moulded body. In rexine covered steel case	£7 4 9	£1 5 3
	"Figaro III"	Vibrator	12 oz	200/250 a.c.	One foil only	Cream moulded body. In rexine covered steel case	£6 1 4	£1 1 2
EVER-READY RAZOR PRODUCTS, LTD., 26-28, Bedford Row, London, W.C.1.	"Fernbrook"	Vibrator	10 oz	200/250 a.c.	Synchronous pulsating motor. Stainless steel outer shear	Pale grey plastic body, chromium head unit, rexine covered steel case	£6 0 1	£1 4 8
	"Fernbrook" with "Close-Clipper"	Vibrator	11½ oz	200/250 a.c.	Synchronous pulsating motor. Detachable stainless steel outer shear and long hair trimmer	Nautical grey plastic body, chromium head unit, red rexine covered steel case	£6 4 0	£1 1 8
	"Standard"	Vibrator	11½ oz	200/250 a.c.	Synchronous pulsating motor, detachable stainless steel outer shear	Nautical grey plastic body, chromium head unit, check design rexine covered steel case	£5 4 1	£0 18 3
HAYNOR, LTD., 167, Greyhound Road, London, W.6.	"Unic"	Battery operated	5 oz	1½ V battery	Spare trimming head available	Cream moulded body	£2 10 0	£0 8 10
LONOR, LTD., 1, Maddox Street, London, W.1.	Siemens SMR14	Double insulated impulse motor	11 oz	100/135 and 200/240 a.c./d.c.	Tandem cutters rotate in opposite directions	Two-tone plastic. Leather case or pouch	£9 19 0	£1 12 0
	Siemens "Cleanmaster"	Re-chargeable battery	7 oz	—	Operates for week without re-charging	Plastic casing and guard cap. Leather pouch	£7 14 11	£1 4 10
	Siemens "Super Cleanmaster"	Re-chargeable battery	10½ oz	—	Operates for week without re-charging, or car battery	Plastic casing and guard cap. Leather pouch	£8 12 2	£1 7 7
PERIHEL, LTD., 146, New Cavendish Street, London, W.1.	"Travelux"	Re-chargeable battery	10 oz	110/240 for re-charging purposes	Rotating cutter head, self-sharpening, on/off switch	Ivory plastic, zipped leather case	£7 7 10	£1 6 8

Manufacturer or Distributor	Name or Model	Type	Weight	Voltage Range	Special Features	Finish	Price (excl. tax)	Purchase Tax
PERIHEL, LTD., 146, New Cavendish Street, London, W.1. (continued)	"Accura"	Storage battery, car battery or mains operated	11½ oz	6 or 110/240 a.c.	Self-sharpening rotary head, on/off switch	Ivory plastic, zipped leather case	£8 15 3	£1 9 3
PHILIPS ELECTRICAL, LTD., Century House, Shaftesbury Avenue, London, W.C.2.	"Philishave" 7910 "Jet"	Mains operated, dual voltage	8½ oz	110/130-200/250 a.c./d.c.	Rotary action. Slide-switch for voltage adjustment	Two-tone plastic	£7 3 6	£1 6 3
	"Philishave" 7779 "Jet"	Battery operated	8½ oz	3 1½ V batteries or, by special adaptor, 6 or 12 V car batteries	Rotary action	Two-tone plastic	£6 9 2	£1 3 7
	"Philishave" 7911 "Jet"	Standard single voltage	8½ oz	200/250 a.c./d.c.	Rotary action	Two-tone plastic	£6 4 3	£1 2 9
PIFCO, LTD., Pifco House, Watling Street, Manchester, 4.	"Pifco" 1126	Vibrator	9½ oz	200/250 and 100/110 a.c.	Wafer-thin cutting head. Complete in plastic container	Cream plastic	£3 7 3	£0 12 3
	"Pifco Prince"	Vibrator	9½ oz	200/250 a.c.	"Varishave" speed adjuster, built-in hair trimmer	Ivory plastic with matching case	£5 1 0	£0 18 6
REMINGTON RAND, LTD., 26-40, Kensington High Street, London, W.8.	"New Remington" Standard	Double insulated impulse motor	11 oz	190/240 a.c./d.c.	"Roller combs," three twin shaving heads	Cream plastic, presentation case	£9 1 0	£1 12 0
	"New Remington" Triple-Volt	Double insulated impulse motor	11 oz	110/130, 140/160 and 190/240 a.c./d.c.	"Roller combs," three twin shaving heads, voltage change switch	Cream plastic, presentation case	£9 17 6	£1 14 11
	"New Remington" Auto-Home	Double insulated impulse motor	11 oz	12 and 190/240 a.c./d.c.	Complete with dashboard fitting for car use	Cream plastic, presentation case	£10 3 6	£1 16 0
	"Four-Most"	Double insulated vibrator motor	11½ oz	210/240 a.c.	Contour curved shaving heads	Two-tone grey plastic, real hide carrying case	£6 9 1	£1 2 10
	"Princess"	Double insulated vibrator motor	7 oz	210/240 a.c.	Contained in jewel-box presentation case	Blush pink	£5 3 11	£0 18 5



1. Remington "Four-Most"
2. New Remington standard model
3. Loner "Cleanmaster" re-chargeable shaver
4. Philips "Philishave Jet"
5. Chilton "Sportsman"
6. Ever Ready Co. (Gt. Britain) "Figaro"

Manufacturer or Distributor	Name or Model	Type	Weight	Voltage Range	Special Features	Finish	Price (excl. tax)	Purchase Tax
B. H. RIES, LTD., 19-21, Hatton Garden, London, E.C.1.	"Richard Cadet"	Rotary head	10 oz	110/140, 200/250 a.c./d.c.	Clipper head available 25/- extra	Red and grey nylon body	£5 15 4	£0 19 8
	"Richard Cadet" De Luxe	Rotary head	10 oz	110/140, 200/250 a.c./d.c.	Complete with clipper head and zip leather pouch	Red and grey nylon body	£7 1 4	£1 3 11
	"Miss Swiss"	Reciprocating head	10 oz	200/240 a.c./d.c.	In presentation box	Pink or white nylon body	£4 1 2	£0 13 10
	"Lord Riam"	Rotary head, battery	8 oz	3 V batteries	In presentation box	Grey or white	£3 6 11	£0 11 5
ROLLS RAZOR, LTD., 255, Cricklewood Broadway, London, N.W.2.	"Rolls Electric Viceroy" V-Ten	Impulse motor	12 oz	90/250 a.c./d.c.	Angled multi-heads, on/off and voltage change switches. Lamp adaptor supplied	Coffee and deep cream plastic body. Silk and velvet lined case	£8 5 3	£1 10 3
	"Rolls Electric Viceroy" A.C.-Four	Vibrator	10½ oz	100/130 and 200/250 a.c.	Multi-heads, on/off and voltage change switches	Beige and maroon plastic body. Travelling case	£6 2 7	£1 2 5
RONSON PRODUCTS, LTD., 352-3, Strand, London, W.C.2.	"Ronson Standard"	Vibrator	9½ oz	100/125 and 200/250 a.c.	On/off switch. Complete in "stow-away" pack	Cream moulded body, black plastic head	£5 12 4	£0 19 8
	"Ronson C.F.L. with Super Trim"	Vibrator	9½ oz	100/120 and 200/240 a.c.	On/off switch, transparent guard, cool running, trims as well as shaves	Decorated moulded body, gold plated head, in presentation case (a) or in leather "trip kit" with toilet accessories (b)	£7 11 1 (a) £8 18 8 (b)	£1 6 5 (a) £1 11 4 (b)
	"Lady Ronson"	Vibrator	7½ oz	200/250 a.c.	Presentation box	Pastel pink or blue	£4 17 0	£0 17 0
SUNBEAM ELECTRIC, LTD., Nerston, East Kilbride, Lanarkshire.	"Silver Glide" "Shavemaster" XCW	16-bar armature motor	12 oz	210/250 a.c./d.c.	Double-edged hollow-ground oscillating cutter. Stand-up case	Plastic and chrome-plated steel. In brown, burgundy, grey, tan, black and white	£8 16 5	£1 12 3
	"Silver Glide" "Shavemaster" XCPL	16-bar armature motor	12 oz	210/250 a.c./d.c.	Double-edged hollow-ground oscillating cutter. In presentation case with pre-shave lotion	Plastic and chrome-plated steel. In brown, burgundy, grey, tan, black and white	£9 6 9	£1 14 2
	"Multi-Volt Shavemaster" XSM	16-bar armature motor	12 oz	110/130, 130/160, 190/250 a.c./d.c.	Double-edged hollow-ground oscillating cutter. In-built voltage selector	Black plastic and chrome- plated steel. Black presentation case	£9 18 8	£1 16 4



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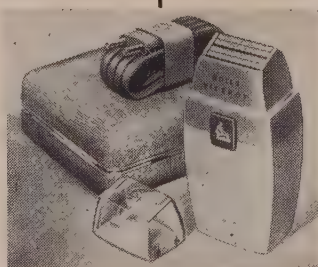
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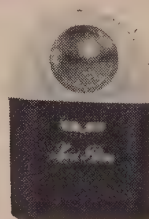
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7. Ries "Richard Cadet"
8. "Ronson C.F.L." with Super Trim
9. Ever Ready Razor Products "Arvin Fernbrook" with close-clipper
10. Pifco "Prince"
11. Rolls "Electric Viceroy V-Ten"
12. Ries "Lord Riam" battery-operated model



13

- 13. Perihel "Travelux" re-chargeable shaver
- 14. Sunbeam "Silver Glide" "Shavemaster" in presentation case with pre-shave lotion
- 15. Welmec "AEG President" re-chargeable shaver

14



15



Manufacturer or Distributor	Name or Model	Type	Weight	Voltage Range	Special Features	Finish	Price (excl. tax)	Purchase Tax
SUNBEAM ELECTRIC, LTD., Nerston, East Kilbride, Lanarkshire. (continued)	"Rollmaster" XR	Impulse motor	12 oz	190/250 a.c./d.c.	3-cutter head and self-adjusting rollers	Ascot grey. Tan presentation case	£8 2 9	£1 9 9
	"Rollmaster" XRM	Impulse motor	12 oz	110/120, 130/160, 190/250 a.c./d.c.	3-cutter head and self-adjusting rollers. In-built voltage selector	Ascot grey. Brown presentation case	£8 19 8	£1 12 10
	"Lady Shavemaster"	Vibrator	6 oz	230/250 a.c. only	Special gift box	Blue, pink or turquoise plastic, and highly buffed gilt finish	£4 16 4	£0 17 7
WELMEC CORPORATION, LTD., 147-8, Strand, London, W.C.1.	AEG "President"	Re-chargeable battery	8½ oz	110/250 for re-charging purposes	4-bladed cutter wheel. Shaver operates on 5 V only	Grey and white plastic. Leather case. Complete with charger and clipping head	£8 8 10	£1 10 11

RESEARCH AND DEVELOPMENT REPORT

THE 10th annual report of the National Research Development Corporation (H.M. Stationery Office, price 1s 3d) reviews the activities of the Corporation in the period July, 1958, to June, 1959. It records the appointment of Mr. J. C. Duckworth as managing director in April this year in succession to Lord Halsbury, who had held that office since the Corporation was established in 1949. The Corporation was set up by the Board of Trade to develop or exploit inventions resulting from public research and any others which were not, in the Corporation's opinion, receiving sufficient interest.

The number of inventions communicated to the Corporation during the year was nearly 700 and the number of patent rights assigned to it nearly 200, both figures being somewhat higher than in the previous year. Government Departments and universities continue to be the main source of supply. At the end of the year the Corporation held the rights in 2,794 United Kingdom and foreign patents or patent applications, of which 1,038 were being actively exploited; and 395 licence agreements with manufacturers were in force, compared with 357 in the previous year.

Among the new projects which were either initiated during the year or reached a stage permitting a report to be made, and which ranged from antibiotics to the "Hovercraft," was a system for achieving economy in the frequency spectrum by transmitted television signals based on proposals by Prof. E. C. Cherry of the Imperial College of Science and Technology. The technique employs a variable scanning velocity, adjusted to keep the transmitted frequencies within a restricted bandwidth. An experimental system based on a 30-line picture has been constructed, and a further system operating on 405 lines is being developed. Further work has been carried out on a number of projects referred to previously, including computer controlled

machine tools,* electronic digital computers, the hydrogen-oxygen fuel cell, printed electrical circuits and variable speed induction motors.

Radio Relay Systems

IN radio trunk systems a number of two-way radio channels are used over a common route with repeaters provided at intervals. Each radio channel carries a base-band signal by frequency modulation of the route carrier frequency. This base-band signal may consist of an assembly of single-sideband telephony channels and/or a television channel.

When choosing the frequency pattern for the radio channels, selectivity requirements are found to arise, not only from the primary fact that the channels are adjacent in the frequency spectrum, but also from secondary features of the equipment such as, for instance, the intermediate frequency used in the heterodyne repeaters.

In a paper prepared by Mr. B. B. Jacobsen (Standard Telephones & Cables, Ltd.) which was read recently at a London meeting of the Electronics and Communications Section of the Institution of Electrical Engineers, consideration is given to effects which give rise to such selectivity requirements and methods of choosing the channel frequency pattern and the intermediate frequency to minimise the selectivity requirements. The choice takes account of amplitude non-linearity in waveguide circuits. The presence of this was expected on theoretical grounds and was confirmed by measurements.

The specific frequency pattern is worked out for a route with six two-way channels in which radio channels can carry at least 600 telephone channels or a single television channel. This requirement was adopted by the Comité Consultatif Internationale Radio (C.C.I.R.) in 1956.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (3s 6d each including postage) are obtainable from the Patent Office, 25, Southampton Buildings, London, W.C.2

1953

16315. Postmaster General.—Time division multiplex communication systems. 22nd December, 1955. (826631.)

1955

2086. National Research Development Corporation.—Electronic digital computers. 2nd December, 1955. (826613.)

4520. General Electric Co.—Semiconductor devices. 1st July, 1958. (826559.)

7135/6. British Aluminium Co., Ltd.—Electrolytic reduction cells for the production of aluminium. 9th March, 1956. (826634/5.)

7863. Hivac, Ltd.—Cold cathode gas discharge tubes. 24th February, 1956. (826724.)

8507. Solartron Electronic Group, Ltd.—Information storage apparatus. 19th March, 1956. (826725.)

8716. National Research Development Corporation.—Electrical testing apparatus. 23rd March, 1956. (826726.)

9447. Telephone Manufacturing Co., Ltd.—Signal detectors. 22nd February, 1956. (826727.)

15603. General Electric Co., Ltd.—Electric discharge lamps. 30th May, 1956. (826615.)

17370. Spence & Sons, Ltd., P.—Electrolytic process for preparing titanium metal. 17th September, 1956. (Addition to 713446.) (826667.)

18138. Dunlop Rubber Co., Ltd.—Electric resistance elements. 19th June, 1956. (826730.)

25776. Sullivan, Ltd., H. W., and Griffiths, W. H. F.—Electrical condensers. 5th December, 1956. (826732.)

28198. Gravinger Manufacturing Co., Ltd. and Wilkinson Sword, Ltd.—Inertia operated electric switches. 4th January, 1957. (826735.)

31464. Westinghouse Brake & Signal Co., Ltd., Duckitt, H., and Tillotson, P.—A.C. track circuits for railway signalling systems. 26th October, 1956. (826553.)

33319. Nielsen Co., Ltd., A. C.—Television receiving apparatus. 21st November, 1955. (826736.)

33837. Philips Electrical Industries, Ltd.—Apparatus for reproducing sound. 25th November, 1955. (826737.)

34636. National Research Development Corporation.—Electronic digital computers. 2nd December, 1955. (Divided out of 826613.) (826612.)

1956

1887. General Electric Co., Ltd.—Electric discharge lamps. 18th January, 1957. (826616.)

2037. National Research Development Corporation.—Electronic digital computers. 20th January, 1956. (Divided out of 826613.) (826614.)

3468. Radio Corporation of America.—Composite photoconductive layer. 3rd February, 1956. (826739.)

4356. Sprague Electric Co.—Electrical condensers. 21st February, 1956. (826672.)

6151. Philco Corporation.—Semiconductive devices. 28th February, 1956. (826744.)

6580. Siemens & Halske A.G.—Regenerative condensers. 2nd March, 1956. (826779.)

7278. Babcock & Wilcox, Ltd.—Power plant, the operation of such plant, and tubular boilers suitable for use in power plant. 8th March, 1956. (826835.)

8850. General Electric Co.—Television receiving apparatus. 21st March, 1956. (826572.)

10732. Telephone Manufacturing Co., Ltd.—Electrical components. 9th April, 1957. (826749.)

13241. General Electric Co., Ltd.—Sodium vapour electric discharge lamps. 29th April, 1957. (Addition to 801482.) (826751.)

17901. Folkes, G. E. (Libbey-Owens-Ford Glass Co.).—Light transmissive electrically conducting article. 9th June, 1956. (826754.)

20632. General Electric Co., Ltd., and Beesley, J. H.—Electric circuits operable to count or distribute electric signals. 2nd July, 1957. (826617.) 20633. Electric pulse generators. 28th June, 1957. (826618.)

24755. Pye, Ltd.—Phase comparison circuits. 2nd August, 1957. (826574.)

25537. General Electric Co.—Method of making contacts to semiconductor bodies. 21st August, 1956. (826560.)

28167. Vigren, S. D.—Arrangement in automatic telephone and telegraph systems. 14th September, 1956. (826758.)

29772. Ferranti, Ltd.—Electrical stages for performing logical functions. 25th September, 1957. (826759.)

30605. Marconi's Wireless Telegraph Co., Ltd.—High frequency wave energy coupling devices. 16th July, 1957. (826760.)

31425. Standard Telephones & Cables, Ltd.—Methods of producing silicon of high purity. 11th October, 1957. (Addition to 745698.) (826575.)

32861. Erzbergbau Salzgitter A.G.—Magnetic separator. 29th October, 1956. (826685.)

33257. Philips Electrical Industries, Ltd.—Methods of sealing together parts of cathode-ray tubes and like vacuum vessels. 31st October, 1956. (826761.)

37491. Ellis, T. W., and Bone, R. H.—Translucent panels. 6th December, 1957. (826688.)

37668. General Electric Co.—Pressure ratio sensing means. 10th December, 1956. (826506.)

1957

76. Alford, A.—Coaxial electric transmission line for high frequency waves. 1st January, 1957. (826509.)

1026. General Electric Co., Ltd.—Low pressure mercury vapour fluorescent electric discharge lamps. 6th January, 1958. (826772.)

1033. Hubbell Inc., H.—Electric outlet receptacles. 10th January, 1957. (826773.)

1931. Electrolux, Ltd.—Absorption refrigerating apparatus. 18th January, 1957. (826511.)

2840. Sperry Rand Corporation.—Control circuit employing semiconductor devices. 25th January, 1957. (826555.)

3035. General Electric Co., Ltd.—Electric lamps. 24th January, 1958. (826579.)

3380. Westinghouse Electric Corporation.—Elevator control systems. 31st January, 1957. (826697.)

4172. Usines Dielectriques.—Heat-hardening electrical insulating tapes and the use thereof. 6th February, 1957. (826512.)

5619. Schrier, J.—Holders for incandescent electric lamp bulbs. 6th December, 1957. (Addition to 696195.) (826777.)

5940. Cooling Towers, Ltd., and Rotbart, P.—Water cooling towers. 21st February, 1958. (826778.)

8424. Sperry Rand Corporation.—Enhancement semiconductor amplifier. 14th March, 1957. (826556.)

8848. Communications Patents, Ltd.—Broadcasting systems. 14th March, 1958. (826782.)

8941. National Research Development Corporation.—Electrical supply regulators. 19th March, 1958. (826783.)

10174. Wago-Klemmenwerk G.m.b.H.—Means for detachably securing leads to electrical connectors. 28th March, 1957. (826580.)

10818. Cole, Ltd., E. K., and Green, H. H. H.—Waveguides. 3rd April, 1958. (826788.)

17306. Allday & Son (1922), Ltd., H.—Protective means for electric circuit socket connectors. 22nd May, 1958. (826792.)

19449. Mullard, Ltd.—Indirectly heated cathodes for electron discharge tubes. 13th May, 1958. (826796.)

23183. Chicago Telephone Supply Corporation.—Electric switch with terminal assembly adapted for connection to printed circuits. 22nd July, 1957. (826797.)

25187. Vyzkumny A Zkusebri Letecky Ustav.—Electromagnetic amplifying inductor. 9th August, 1957. (826799.)

25928. Standard Telephones & Cables, Ltd.—Semiconductor devices. 16th August, 1957. (826800.)

26281. Mullard, Ltd.—Manufacture of thermionic cathodes. 20th August, 1958. (826802.)

33724. General Electric Co.—Neutronic reaction fuels. 29th October, 1957. (Addition to 796989.) (826529.)

34356. Siemens & Halske A.G.—Tubular capacitors. 4th November, 1957. (826807.)

38375. Western Electric Co., Inc.—Permutation code signal transmitters. 10th December, 1957. (826718.)

40101. Western Electric Co., Inc.—Electromagnetic waveguide couplers. 24th December, 1957. (826810.)

1958

594. Burndy Corporation.—Sockets for electrical connectors. 7th January, 1958. (826720.)

7437. Sulzer Freres S.A.—Nuclear power plants having heterogeneous nuclear reactors. 7th March, 1958. (826591.)

11826. Parmatic Engineering, Ltd.—Hermetically sealed pressure sensitive electric switches. 14th April, 1958. (826598.)

22509. British Telecommunications Research, Ltd.—Electrical trigger circuits. 14th July, 1958. (Addition to 801681.) (826604.)

TRADE MARKS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to 16th January:—

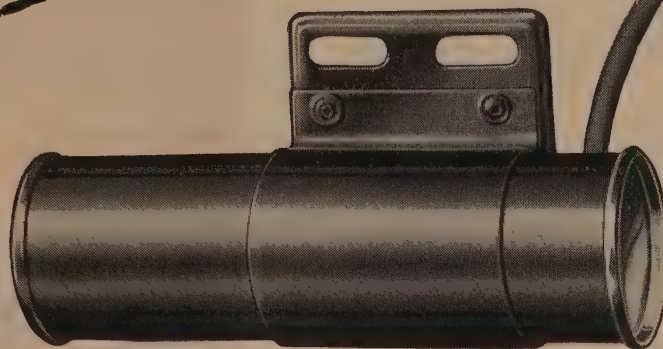
Sylflex (design). No. 789,646. Class 7. Electrically operated machines for treating leather.—Dow Corning Corporation, Midland, Mich., U.S.A. Address for service, c/o Elkington & Fife, Bank Chambers, 329, High Holborn, London, W.C.1.

Communscope. No. 779,720. Class 9. Electric and electronic instruments; sound recording and sound reproducing instruments, etc.—U. R. Farner, Zurich, Switzerland. Address for service, c/o Wilson, Gunn & Ellis, 57, Market Street, Manchester, 1.

Decca Varitrack. No. 786,061. Class 9. Scientific and electrical apparatus and instruments; nautical, surveying, navigating, optical, radio, radar, television, signalling, teaching and measuring apparatus and instruments; and insulated electric cables.—Decca Record Co., Ltd., 9, Albert Embankment, London, S.E.11.

No. 793,497 (design). Class 9. Electric cables and electric connections therefor.—Microdot, Inc., South Pasadena, Cal., U.S.A. Address for service, c/o Reddie & Grove, 6, Bream's Buildings, London, E.C.4.

Flasherking. No. B789,805. Class 11. Electric hand lamps.—Meyer Manufacturing Co., Ltd., Kowloon, Hong Kong. Address for service, c/o Cope & Co., 65, Victoria Street, London, S.W.1.



*Off to a
good start—
every time*

Dubilier Motor Starting Capacitors are tough and reliable. The capacitor element is hermetically sealed in an aluminium container, which is in turn housed in a seamed, metal outer casing with a strong mounting bracket.
Available in three ranges:—
150V: from 45 to 280 μ F. 275V: from 15 to 130 μ F.
350V: from 20 to 100 μ F.
They are suitable for operation at temperatures up to 60°C.

DUBILIER

DUBILIER CONDENSER CO. (1925) LTD • Ducon Works, Victoria Road, North Acton, London W.3 • Tel: ACOrn 2241 (5 lines)
Cables: Hivoltcon, London

Grams: Hivoltcon, London Telex • Telex 25373 DN229

*For high performance
and reliability*

Secomak
REGD.

**HIGH VELOCITY A.C.
BLOWER-SUCTION FANS**
are the answer

These units are the outcome of further developments in the well-known range of Secomak blower, suction and booster fans. Capable of high w.g. pressures they are much smaller, lighter and more economical than conventional fans of equivalent outputs. They are of proved reliability. Our wide experience of industrial applications is at your disposal.

SERVICE ELECTRIC CO. LTD.

HONEYPOT LANE, STANMORE, MIDDX.

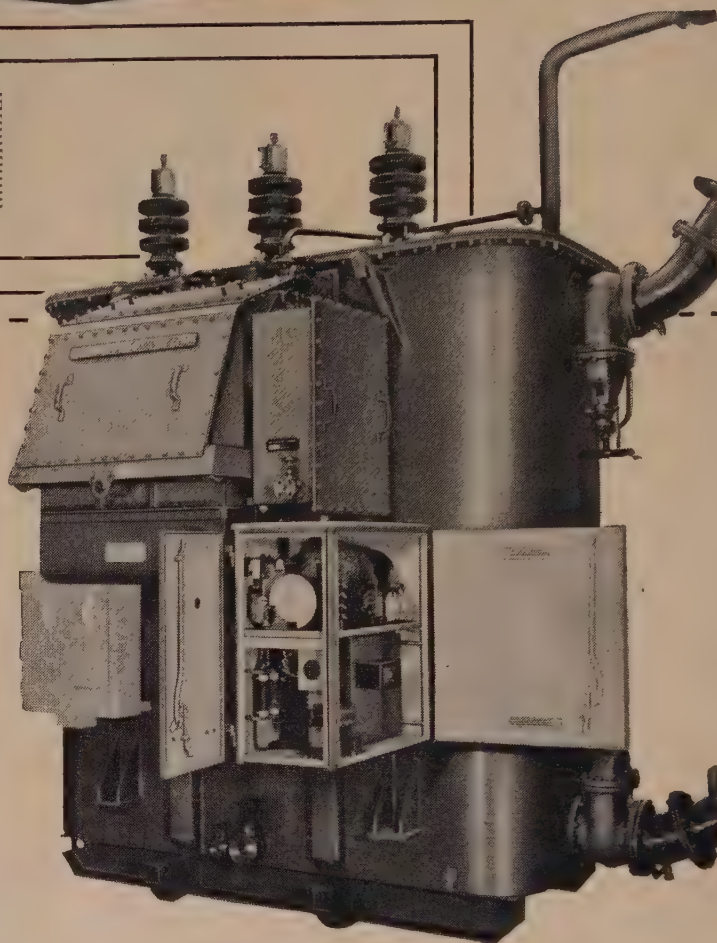
Telephone: EDGware 5566-9

On-load Tap Changers

TYPE

M

Designed for use on transformers of up to 275 kV, the Type M tap changer has a simple and reliable operating mechanism which ensures completion of tap change. Transition resistors—liberally rated and mechanically robust—minimize arcing and burning at the contacts of the diverter switches, and ease the switching duty. The complete tap changer with its motor driving gear is compactly assembled as a single, iron-clad unit and bolted to a flange on the transformer tank.



Other important features :

- Any number of steps up to 18 can be accommodated
- Once initiated, a tap change cannot be interrupted
- Continuity of supply maintained during a tap change
- Separate drop-down tank allows convenient inspection of diverter switches
- Diverter switches are rapid in operation
- Contact bounce at diverter switches eliminated
- Minimum voltage variation during a tap change
- Moving contacts have single bolt fixing and are accessible from the front.

Write for details to:-

A.E.I. TRANSFORMER DIVISION, SOUTHMOOR ROAD, WYTHENSHAW, MANCHESTER 23

Associated Electrical Industries Limited
TRANSFORMER DIVISION
Manchester 23 and Rugby

NEW ELECTRICAL EQUIPMENT

Lighting Fittings

The "Ovalacent" flush-type lighting fitting, manufactured by HEYES & Co., LTD., Wigan, is now available with a glass cover as an alternative to the original "Perspex." This development is accompanied by an increase in capacity and a reduction in price. For example, type 1330 with glass cover becomes 100 W at £1 11s instead of 60 W at £2 2s, and type 1331 becomes 150 W, with an 11s reduction in the list price throughout the range. The advantage of a "Perspex" cover is that it obviates the need for wire-guards, but unless the installation is in a vulnerable position, unguarded glass covers are claimed to be equally suitable.

The fittings have been designed for use in situations where it is impossible or undesirable to chase out brickwork or cut into a ceiling to accommodate a lighting fitting. They have no back projection but give the effect of a flush fitting. The larger capacity types have been designed for surface conduit and back conduit entry.

The company has also produced a marine, weatherproof version, type 1333. This unit is primarily designed as an alternative to the 323 "Wigan" prismatic fitting. It has machine-faced joints and gaskets and a cemented glass cover and a capacity of up to 150 W. There is space for looping-in and ample surface on its two ends for up to six watertight cable glands. The lampholder is mounted on a readily detachable bracket in the interior of the joint boxes. Drilling or special glands can be ordered as extras, the standard fitting being supplied undrilled.

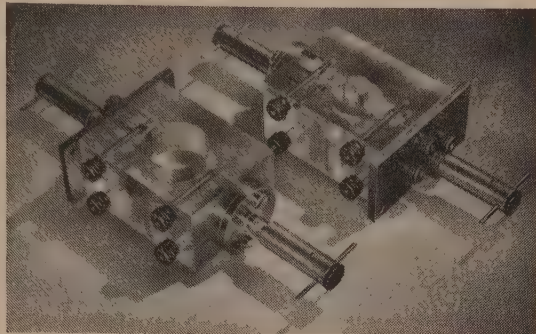
Plastic Cable Jointing

Injection moulding equipment providing a semi-accessible joint in polythene-sheathed cables which is not subject to deterioration from atmospheric or other causes has been developed by the TELEGRAPH CONSTRUCTION & MAINTENANCE CO., LTD., Mercury House, Theobald's Road, London, W.C.1. Its principal features are an improved injection gun and non-heated "Perspex" moulds.

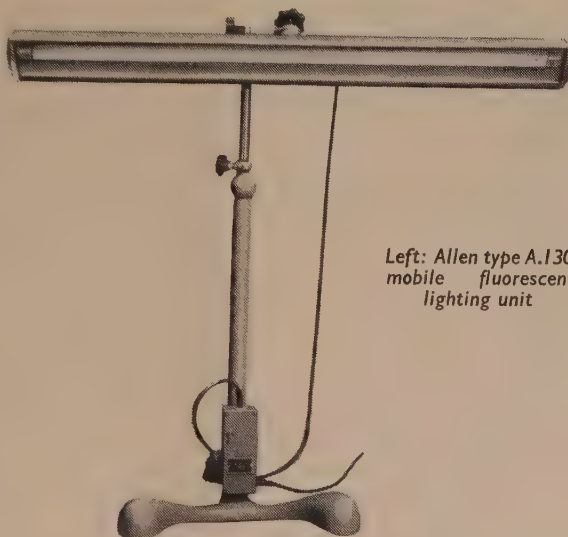
The transparency of the moulds permits the injection process to be seen whilst the joint is being made. A piece of polythene tubing is placed over one cable end and the conductors are twist jointed and soldered. After the conductor joints are insulated with polythene or similar tape, or by polythene sleeves, the sheath joint is carried out by moulding a ring of polythene around the cable sheath on both sides of the joint and placing a polythene tube over the ring mouldings. Further injection mouldings, one at each end of the joint, seal off the tube edges, the outer face of the rings and the cable sheath.



Heyes type 1333 weatherproof "Ovalacent" lighting fitting



Telcon cable jointing moulds



Left: Allen type A.130 mobile fluorescent lighting unit



London Commercial Electrical Stores "Soltanette" infra-red health lamp

The joint may be cut open and resealed several times if necessary. Another type of mould can be clamped to the side of cables for the repair of small blemishes caused, for example, by mishandling. This technique is especially suitable for use with large size cables with polythene oversheath. The equipment may be used for the jointing of any type of cable having a polythene outer sheath, e.g. power and control cables.

Mobile Fluorescent Lighting Unit

A portable fluorescent inspection light, type A.130, has been introduced by P. W. ALLEN & Co., 253, Liverpool Road, London, N.1. Fully adjustable and mobile, the unit is designed to provide cool, glare- and shadow-free light for maintenance workers in such places as power stations, telephone exchanges, process control plants, etc. Its 4ft 40 W fluorescent tube is housed in a metal reflector with a clear Perspex front cover.

The reflector can be moved in any direction and locked as required, while a telescopic column allows for height adjustment. The three-legged heavy base has rubber tyred castors for ease of movement and is claimed to be

perfectly stable regardless of the lamp position. The control gear and switching is contained in a metal case at the base of the centre column. The price, including fluorescent tube, is £22.

Infra-Red Health Lamp

The latest addition to the range of health lamps obtainable from LONDON COMMERCIAL ELECTRICAL STORES, LTD., 20-22, Cursitor Street, London, E.C.4, is the "Soltanette" infra-red model. Attractive in appearance, it is fitted with an anodised gold coloured reflector and a gold plated stand and protecting guard. A long-wave 250 W dull-emitter generator or a 400 W mixed-wave radiant heat generator can be supplied with the lamp. Provided with a suitable length of 3-core flexible, it is priced at £3 5s and sold only against a doctor's certificate. A 300 W long-life high-emission ultra-violet irradiator, complete with a pair of eye-shields, is available for £4 12s 6d extra.

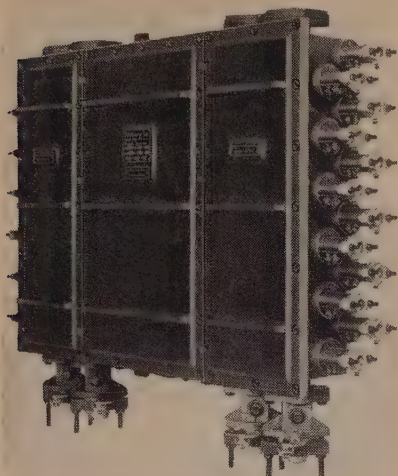
Conductive P.V.C. Compound

A conductive p.v.c. compound which has been used to replace the copper conductor in automobile

ignition cables and the copper braiding in coaxial cables has been developed by the American company, Abbey Plastics, Inc., and is being marketed in this country by CROXTON & GARRY, LTD., 16-18, High Street, Kingston-on-Thames, Surrey, under the trade name "Abbey 100." The thermo-plastic compound has a resistivity of $7 \Omega/\text{cm}^2$ and is available in the form of $\frac{1}{8}$ in chips at prices varying from 15 to 20s per lb, depending on quantity.

Flameproof Connecting Boxes

The range of connecting boxes introduced by W. & H. NELSON, LTD., Nelbest Works, Mossend, Lanarkshire, Scotland, is rated for 660 V and 15 A and comprises four basic sizes.



Nelson flameproof connecting box

The type JJ47 measures 14 $\frac{1}{2}$ in wide and 11 in by 6 in, allowing up to six links, and the JJ48 is 6 $\frac{1}{2}$ in higher to accept a maximum of 15 links. The group JJ49-50-51 measure 40 $\frac{1}{2}$ in by 15 $\frac{1}{2}$ in by 6 in covering maxima of 20, 30 and 45 links respectively; and JJ52 and JJ53, for up to 60 and 90 links respectively, measure 40 $\frac{1}{2}$ in by 31 in by 6 in. The case of each box is of mild steel complying with B.S. 229 for flameproof enclosures.

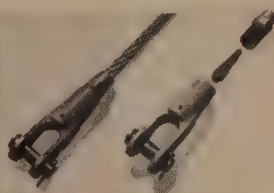
The boxes also meet the relevant F.L.P. certificates, Groups 1 and 2. The sliding link bars are so constructed that cable connections are not disturbed when sliding the test link clear for testing purposes. The terminals are separated by insulated barriers and the terminals and links are numbered and labelled according to specification. The boxes are illustrated on Leaflet No. 2/106 which may be obtained on application.

Wire Rope Terminal

The range of "Tullcon" wire rope terminals manufactured by the TULLOCH CONSTRUCTION CO., LTD., 8, Laurence Pountney Hill, Cannon Street, London, E.C.4, can be fitted on site by unskilled labour without the need for heating or degreasing.

The complete terminal consists of a

sleeve, a grooved and tapered pin and a terminal-head. The end of the wire, from which a short length of core has been removed, is passed through the sleeve and the tapered pin is driven into the centre of the wire where it passes through the sleeve, each strand being



Tulloch wire rope terminal

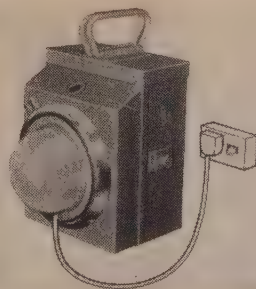
laid in a groove in the pin. The ends of the strands are then inserted in the terminal-head, which is screwed into the sleeve. The screwing action re-lays the wire above the pin, making it impossible to withdraw the wire. An inspection hole in the terminal-head enables the operator to see whether sufficient wire has been inserted.

Shackle and stud end terminal-heads are at present stocked but other types, such as bottle-screws and eye-ends, can be made to customers' requirements.

Emergency Lighting Unit

A portable automatic emergency lighting unit which operates immediately on a mains failure has been introduced by NIFE BATTERIES, LTD., Redditch, Worcestershire. Known as the type R.E.6, it comprises a six-cell steel alkaline battery in a steel case fitted with a lid and carrying handle. The bulb holder, double filament 3 W and 18 W 6 V bulb and a simple relay unit are mounted in the lamp front, to which is connected a flexible lead from the 220/250 V a.c. supply. The relay is held in the open position by the a.c. mains and closes instantly on mains failure, thus connecting the 3 W reserve filament of the bulb to the battery. If additional light is required the switch on the lamp front can be depressed to connect the 18 W main filament.

The battery will operate the 3 W filament for approximately 20 hours, or the 18 W filament for three hours, before recharging is necessary, which



Nife emergency lighting unit

can be carried out by chargers that can be adjusted to supply approximately 1.5 A at 8.4 to 10.8 V. The unit measures 9 in high by 8 in wide by 7 $\frac{1}{2}$ in long and weighs approximately 13 lb.

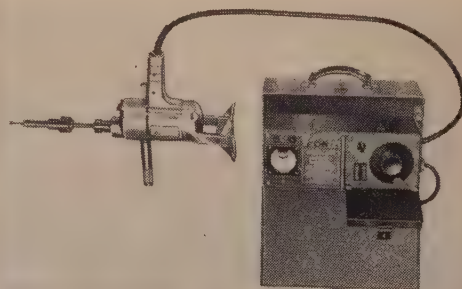
Ceramic Capacitors

High permittivity ceramic capacitors having stable temperature/capacitance and voltage/capacitance characteristics coupled with low ageing rates have been introduced by STABILITY CAPACITORS, LTD., Commerce Estate, Raven Road, London, E.18. Available with capacities ranging from 75 to 2,200 pF, with tolerances down to ± 5 per cent, the capacitors are suitable for operation in temperatures between -60 and $+100^\circ\text{C}$ and are rated at 500 V d.c., being tested at 1,500 V d.c. The insulation resistance is better than 100,000 M Ω at 500 V d.c. after one minute, and the change in capacitance after being subjected to the maximum d.c. working voltage and temperature for 2,000 hours is less than 0.25 per cent.

Tube Expander Control Unit

The Mark IV electric automatic torque control unit announced by CHARLES WICKSTEED & CO., LTD., of Kettering, Northants., regulates condenser and heat exchanger tube expansion by determining and limiting the torque requirements of the expander tool. The range of tubes which can be handled by the unit is approximately $\frac{3}{8}$ to 1 in outside diameter, though sizes closely outside this range can be accommodated according to conditions of material, tube sheet thickness and tube wall thickness. The unit is contained in a steel case 14 in by 9 in by 6 in, weighing 19 lb, and the torque setting control has a separate lockable lid to prevent alteration by unauthorised persons.

The units are suitable for the dual voltage range of 100/120 or 210/240 V 40/60 c/s, and a 15 A supply is adequate. An indicator knob and dial are provided for compensating voltage variation. The standard equipment includes a voltmeter, mains warning light, voltage range selector plugs, spare fuses, a length of cable and a plug, an expander motor, and one adjustable ball bearing thrust type expander with spares and three sizes of coupling adaptors.



Wicksteed tube expander control unit



CHOOSE MEM AUTO-MEMOTA

the starter that's been proved all over the world

A HUGE TOTAL of Auto-Memota starters is now in service in all kinds of industries all over the world. The Auto-Memota has proved its ability to protect electric motors on even the

most vital duties. Fitted with indirectly heated thermal overload trip on each phase and inherent no-volt release. Made in direct and star-delta types for motors up to 15 HP.



MIDLAND ELECTRIC MANUFACTURING COMPANY LIMITED • TYSELEY • BIRMINGHAM 11

Aeroflex

LINE FUSES

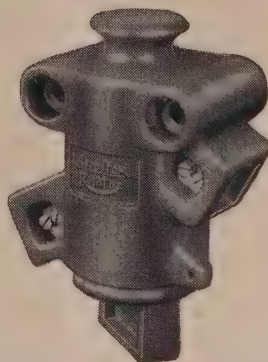
The two types of Line Fuses, differing only in connection, meet a steady demand, for instance, in the protection of pole-mounted transformers.

Incorporating Aeroflex AD and FC type rewirable cartridge fuse-links, they have the characteristics necessary to provide discriminatory reaction to faults; e.g. priority can be given to consumers' fuses on house service cut-outs.

The subject is fully dealt with in our publication No. AL2.

OVERHEAD LINE FUSES

The illustration shows examples from a considerable range of overhead line fuses to suit different situations:—on the left an Aeroflex 60 amp. Rotaloc line fuse is shown, suitable for securing to the cross bar of a line support, and having an adaptable fuse handle carrying an Aeroflex high breaking capacity 60 amp. ADS type rewirable cartridge fuse-link. The right hand illustration shows a 200 amp. porcelain enclosed line fuse, embodying Link Type handle with Aeroflex Ceram high breaking capacity rewirable cartridge fuse-link.



Parmiter Hope & Sugden Ltd.

FLUENT ELECTRICAL WORKS • LONGSIGHT • MANCHESTER 12

London: 34 Victoria Street, S.W.1.

Glasgow: 5 Somerset Place, C.3.

Birmingham: 39/41 Carrs Lane, 4.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses

Ayr.—County Council. Trunk road lighting equipment. (See this issue.)

Basildon.—U.D.C. Lighting installation in office block in town centre. (See this issue.)

Belfast.—11th January. Electrical installation in St. Augustine's Boys' Voluntary Intermediate School, Ravenhill Road. Scottish Boiler & General Insurance Co., Ltd., 10, Donegal Square South.

Corporation. 22nd January. Electrical stores for twelve months commencing 1st May next. (See this issue.)

Bootle.—Corporation. Electric cables and electrical goods (Form No. 13), and electric lamps (Form No. 14), for one year to 31st March, 1961. Borough surveyor, Town Hall.

Glanford Brigg.—R.D.C. 7th January. Duplicate sewage pumps, complete with electric motors, starters and accessories, to be installed at Wrawby. John H. Haiste & Partners, consulting engineers, Belmont House, 20, Wood Lane, Headingley, Leeds, 6.

India.—India Supply Mission. 17th February. Two 30,000 kW steam turbo-alternators. (See this issue.)

Iran.—Plan Organisation, Teheran. 23rd January. Lead covered telephone cable. (E.S.B. 29678/59. Ten/44049.)*

Luton.—Corporation. 28th January. Erection and wiring of 440 class "B" lighting columns. (See this issue.)

Nigeria.—Electricity Corporation of Nigeria, Lagos. 20th January. House service meters. (E.S.B. 29575/59. Ten/43991.)*

Pakistan.—Water and Power Development Authority, Lahore. 15th January. Control room equipment for the Wah grid station. (E.S.B. 29524/59/I.C.A. Ten/44004.)*

Wallasey.—Corporation. 20th January. Electric cables (Form No. 14), and electric lamps (Form No. 15), for the year ending 31st March, 1961. Borough surveyor, Town Hall.

Westminster.—City Council. 18th January. Electric lamps for the year commencing 1st April next. Town clerk, Westminster City Hall, P.O. Box 141, London, W.C.2.

ORDERS PLACED

Chester.—Corporation Education Committee. Accepted. Electrical installations in the third instalment of the College of Further Education (£15,103).—Engineering Service Installations, Ltd.

Keynsham.—U.D.C. Accepted. Electrical work in 41 traditional type dwellings to be erected on the Hawthorns estate (£2,311).—J. F. Hodgson.

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors

Aberdeen.—Houses (100) as redevelopment of Castlehill Barracks site; city architect, 11, Broad Street.

Barking.—Flats and maisonnettes (374), Linton Road/Church Road redevelopment areas; borough architect, Town Hall.

Basildon.—Omnibus garage; Eastern National Omnibus Co., Ltd., New Street, Chelmsford.

* Specifications may be inspected at the Export Services Branch, Board of Trade, Lacon House, Theobald's Road, London, W.C.1 (Chancery 4411; extension 769).

Billericay.—Houses (286), Outwood Common; Coward & Co., Ltd., 101, Lower Anchor Street, Chelmsford.

Birkenhead.—Mineral water factory, Bridge Street, for Moorhouse Bros., Ltd., Liverpool; J. B. Johnson & Co., Ltd., 17, Overton Street, Liverpool.

Bishop Auckland.—Houses (50) at Woodhouse Close; J. Ford, U.D.C. surveyor.

Bognor.—Bungalows (112), Madeira Avenue; Bognor Investment Co., Ltd., Lane House, Walton Avenue.

Brighton.—Occupation and training centre in Coldean Lane (£51,000); D. J. Howe, borough engineer, 26/30, King's Road.

Bristol.—Office block, Marsh Street; Morrison, Rose & Partners, architects, 4, Wimpole Street, London, W.1.

Bury St. Edmunds.—Council chamber and county library; West Suffolk county architect, Westgate Street, Bury St. Edmunds.

Cannock.—Factory and depot for Bow-maker Plant, Ltd.; T. G. Construction Co., Ltd., 50, Park Street, London, W.1.

Canterbury.—Reconstruction and extension scheme (£100,000); Slatters of Canterbury, Ltd., St. Margarets Street.

Cardiff.—Works, Newport Road; Universal Plant Hire, Ltd., 24, College Street, Burnham-on-Sea.

Carlisle.—R.C. church; J. B. Dand, architect, 77, Warwick Road.

Charlton Kings.—Old people's home, East Court (£61,700); county architect, Shire Hall, Gloucester.

Chelmsford.—Extensions to Mid-Essex Technical College, including three- and four-storey teaching block and two-storey workshop block (£189,000); H. Conolly, county architect, County Hall, Chelmsford.

Coseley.—Swimming baths on site between Square Street and The Paddock (£100,000); surveyor, Council House, Coseley, Bilston, Staffs.

Cranford.—Houses and flats (135), Cranford Lane; Lewood, Ltd., Sandhurst Road, Sandhurst, Camberley.

Crewes.—Arts and science block, assembly hall and dining and kitchen block at County Training College (£165,000); E. Taberner, Cheshire county architect, County Offices, Chester.

Croydon.—Additional factory block; Bailey Meters & Controls, Ltd., Purley Way.

Shops (85), for Croydon Centre Developments, Ltd.; Ronald Ward & Partners, architects, 29, Chesham Place, London, S.W.1.

Darlington.—Houses (172), Lingfield estate; F. Shepherd & Sons, contractors, Blue Bridge Lane, York.

Dartford.—Houses (100), Fleet Downs estate; W. J. Simms, Sons & Cooke, Ltd., Beddington Lane, Croydon.

Easington.—Houses (54), Cold Hesledon; M. D. Lilley & Son, builders, Back Woods Terrace, Merton.

Edenbridge.—Factory; W. G. Walker & Co. (Engineers), Ltd., Emery Hill Street, London, S.W.1.

Ennerdale.—Houses (127), Cleator Moor, Parton, Frizington and Egremont; R.D.C. surveyor, Cleator, Cumberland.

Exeter.—Bus and coach station, Paul Street (about £150,000); H. B. Rowe, city architect, Municipal Offices.

Falkirk.—Houses (84), Randyford Steading; burgh surveyor.

Fleet.—Service station and showrooms, King's Road and Aldershot Road; Pondtail Garages, Ltd., 113, King's Road.

Gloucester.—Factory, Eastern Avenue, for Audley Engineering Co., Ltd.; T. G. Construction, Ltd., 50, Park Street, London, W.1.

Grantham.—Houses (150), as first part of development of the Earlsfield estate; borough engineer, Guildhall.

Guildford.—Municipal offices; Scott, Brownrigg & Turner, architects, Archway House, Commercial Road, Woking.

Havant.—Factory and offices; Hennessy Products (Hants.), Ltd., South Street.

Hertford.—Houses (230), Brickendon estate; Compton Bros., Ltd., 185, Beaconsfield Road, Enfield.

Launceston.—Assembly hall, gymnasium, teaching and administrative rooms, kitchen, etc., Launceston College; county architect, County Hall, Truro.

Leeds.—Thoracic unit, Killingbeck Hospital, Seacroft; Walter G. Birch, Ltd., builders, Cold Bath Road, Harrogate.

Leicester.—Junior school, Glenfield; T. A. Collins, architect, 123, London Road.

Liverpool.—Nine-storey offices, Water Street/Drury Lane site; Commercial Union Assurance Co., Exchange Buildings, 2.

London.—Flats (48), Homerton High Street, Hackney; borough engineer.

Hotel extension, Kensington Palace Gardens; Myton, Ltd., Western House, Western Avenue, W.5.

Dwellings (246), Smithy Street, Stepney; W. J. Simms, Sons & Cooke, Ltd., Beddington Lane, Croydon.

Works extensions, Streatham; Smith Meters, Ltd., Rowan Road, S.W.16.

Manchester.—Houses (134), Hawk Green, Marple; director of housing, Room 626, Town Hall.

Middlesbrough.—Additions, Newton Street, for Sowerby & Son; Kitching & Co., architects, 21, Albert Road.

Bungalows (82), Malvern Drive, etc.; Duncanson & Son, builders, Acklam Road.

Offices, James Street, for Middlesbrough Casements, Ltd.; Stephen Coates, Ltd., builders, North Ormesby.

Newcastle-on-Tyne.—Factory additions, Albion Road, for Domestos, Ltd.; Cackett, Burns Dick & MacKellar, architects, 21, Ellison Place.

Fifteen-storey blocks of flats, Westgate Road, Church Street and Pottery Bank; city architect, 18, Cloth Market.

Newmarket.—Houses (49); surveyor, Park Lane, Newmarket, Suffolk.

Northumberland.—Secondary/technical school, Haydon Bridge (£172,000); C. C. Brown, county architect, County Hall, Newcastle-on-Tyne.

Primary school, Wooler (£20,000 for first stage); Cawood Wharton & Co., Ltd., contractors, Harrogate.

Nottingham.—Workshops, laboratories, classrooms, etc., as extensions to Nottingham and District Technical College (£365,250); city surveyor, Guildhall.

Plymouth.—Showrooms and offices, Armada Way; Evans, Powell & Powell, architects, 110, Castle Circus House, Torquay.

Romford.—Community centre, Harold Hill (£38,700); town clerk, Town Hall.

Showrooms and offices, North Street; Central Commercial Properties, Ltd., Dorland House, Regent Street, S.W.1.

Rothbury.—C.E. secondary school; J. H. Napper, architect, 56, Eldon Place, Newcastle-on-Tyne.

Sedgley.—Houses (150), Hickmerelands estate; Joseph Webb & Co., Ltd., 1, Ivy House Lane, Coseley.

Sheffield.—Medical and dental centre, Bellfield Street/St. Philip's Road site; city architect, Town Hall, 1.

Skipton.—Out-patients' and casualty wing for General Hospital; R. W. Gregory &

(Continued on page 44)

WORK IN PROSPECT (continued)

Partners, consulting engineers, 1, Brazenose Street, Manchester.

Southampton.—Flats (194), Northern Road area; G. T. Crouch, Ltd., Kingston House, Crawley.

Southend-on-Sea.—Police headquarters; borough architect.

Staffordshire.—Fire brigade headquarters at Stafford and fire stations at Newcastle, Lichfield and Tipton; county architect, County Buildings, Stafford.

Stevenage.—Out-patients' centre (£70,000); Dunham, Widdup & Harrison, architects, 42, Hastings Street, Luton.

Stockton-on-Tees.—Houses (55), Hardwick estate; Richard Costain, Ltd., contractors, 16, Great North Road, Newcastle-on-Tyne.

Stoke-on-Trent.—Physics and chemistry blocks, North Staffs Technical College; J. R. Piggott, architect, Kingsway Chambers.

Stratford-on-Avon.—Houses (78), Henley-in-Arden, for R.D.C.; Gregory Housing, Ltd., builders, Farncombe Road, Worthing.

Stroud (Glos.).—Extensions to secondary technical school (£163,000); county architect, Shire Hall, Gloucester.

Sunderland.—First stage of Monkwearmouth Comprehensive School (£265,000); D. & J. Ranken, Ltd., contractors, Stockton Road.

Shops and flats, Melbourne Place; J. W. Ridley, Ltd., builders, 33, West Sunniside, Sunderland.

Mineral water factory, Westbourne Road, for Frucose, Ltd.; G. T. Brown & Son, architects, 53, Fawcett Street.

Swansea.—Second phase of new general hospital, Singleton; D. Garbutt Walton, architect, 5/7, Museum Place, Cardiff.

Tynemouth.—Development of 120 acres of land at Shiremoor Farm, New York; R. Sleightholme, Ltd., builders, Barras Avenue West, Blyth.

Houses (67), Murton Grange estate; William Leech, Ltd., builders, St. James Street, Newcastle-on-Tyne.

Walsall.—Block of shops, Digbeth; Hickton, Madeley and Salt, architects for scheme, Hatherton Road, Walsall.

Watford.—Bank and offices, High Street; Westwood, Sons & Partners, architects, 21, Suffolk Street, London, S.W.1.

Wheatthampstead.—Memorial hall, Marford Road; Hopson Hill & Partners, architects, 2, Leyton Green, Harpenden.

NEXT WEEK'S EVENTS

Organisers of electrical functions are advised to make use of the "Electrical Review" clearing house, Room 221, Dorset House, Stamford Street, London, S.E.1, to ascertain that proposed dates for their functions do not clash with others already arranged

MONDAY, 4th JANUARY

Birmingham.—James Watt Memorial Institute, 6 p.m. I.E.E. South Midlands Centre and Education Discussion Circle. "Post-Graduate Academic Training given within Industry," by R. F. Marshall.

Bolton.—Railway Hotel, Trinity Street, 7.45 p.m. A.S.E.E. Bolton Branch. "Fire Protection by the Mulsifire System," by R. J. Mowle.

Ilford.—Angel Hotel, 8 p.m. A.S.E.E. Essex Branch. Discussion on "Motions for Annual Conference."

Leeds.—Great Northern Hotel, 7.30 p.m. A.S.E.E. Leeds Branch. "Radio Control," by E. B. Hill.

Liverpool.—Donnan Laboratories, Vine Street, 6.30 p.m. I.E.E. Mersey and North Wales Centre. "Silicone Electrical Insulation," by J. H. Davis.

Morden.—Crown Hotel, A.S.E.E. South West London Branch. New Year's party.

Newcastle-upon-Tyne.—County Hotel, Neville Street, 6.30 p.m. North East Electrical Club. "The Jointing of L.V. P.V.C. Mains Cables," by E. C. Maton and J. Arren.

Sheffield.—Royal Victoria Hotel, 7.30 p.m. A.S.E.E. Sheffield Branch. "Earth Impedance and Earth Leakage Testing," by P. Laughton.

TUESDAY, 5th JANUARY

Hammersmith.—Windsor Castle Hotel, 134, King Street, 7.30 p.m. A.S.E.E. West London Branch. "Motor Control Gear," by R. F. Mathieson.

London.—Savoy Place, W.C.2, 5.30 p.m. I.E.E. Measurement, Supply and Utilisation Sections. "A New Method for Observing the Phenomena of Commutation," by H. J. H. Sketch, P. A. Shaw and R. J. K. Splatt; "A Method of Measuring Self-Inductances Applicable to Large Electrical Machines," by Professor J. C. Prescott and A. K. El-Kharashi.

Manchester.—Engineers' Club, 17, Albert Square, 6.15 p.m. I.E.E. North Western Centre. Second Hunter Memorial Lecture. "The Protection of Electrical Systems," by H. G. Bell.

College of Science and Technology, 3 p.m. I.E.E. North Western Centre. School-children's Christmas holiday lecture. "Colour Television," by Dr. Ing. R. Feinberg.

Reading.—Marquis of Lorne, Friar Street, 7.30 p.m. A.S.E.E. Reading and Districts Branch. "Floor Screens, with particular reference to Floor Warming," by H. C. Young.

WEDNESDAY, 6th JANUARY

Halifax.—Crown Hotel, Horton Street, 7.45 p.m. A.S.E.E. Halifax Branch. "Floor Heating."

Manchester.—Engineers' Club, Albert Square, 7.15 p.m. A.S.E.E. Manchester Branch. Branch lectures.

Middlesbrough.—Cleveland Scientific and Technical Institution, 6.30 p.m. I.E.E. Tees-

Side Sub-Centre. North Eastern Centre Chairman's Address, by H. Watson-Jones.

Portsmouth.—C.E.G.B. Offices, 6.30 p.m. I.E.E. Southern Centre. "Non-Destructive Testing," by E. McCabe.

Preston.—R.A.F.A. Club, East View, 7.30 p.m. A.S.E.E. Preston Branch. "H.M. Factories Acts in Relation to Electrical Installation," by D. A. Picken.

Swansea.—South Wales Electricity Board, The Kingsway, 6.30 p.m. I.E.E. Swansea Group. Chairman's address, by J. R. Smith.

Wood Green.—Civic Centre, Town Hall, N.22, 8 p.m. A.S.E.E. North London Branch. Films evening. Film of the Electrical Engineers (A.S.E.E.) Exhibition, and "New Light on Niagara."

THURSDAY, 7th JANUARY

Chelmsford.—Crompton's Social Hall, 7.30 p.m. Chelmsford Engineering Society. "The Development of the Modern Television Camera Tube," by W. E. Turk.

London.—Savoy Place, W.C.2, 5.30 p.m. I.E.E. ordinary meeting. "The Protection of Electrical Systems," by H. G. Bell.

Swindon.—Technical College, 6 p.m. I.E.E. Western Centre. "The Deltic Locomotive," by C. M. Cock. (Joint meeting with the I.Mech.E. Western Branch.)

FRIDAY, 8th JANUARY

Birmingham.—The Gosta Green College of Technology, Aston Street, 7 p.m. Society of

Instrument Technology. "Control Systems as Applied to Railway Signalling," by J. C. Kubale.

Cambridge.—Dorothy Restaurant, 7 for 7.30 p.m. I.E.E. East Anglian Sub-Centre. Annual dinner-dance.

Liverpool.—Industrial Development Centre, M.A.N.W.E.B., Paradise Street, 7.30 p.m. A.S.E.E. Liverpool and District Branch. "Control Centres for Modern Industry," by R. Ritchie.

London.—Savoy Place, W.C.2, 6 p.m. I.E.E. Medical Electronics Discussion Group. Discussion on "Electrical and Electronic Techniques in Respiratory Research," opened by Prof. R. Woolmer and D. W. Hill.

Caxton Hall, S.W.1, 6.30 p.m. Electrical Power Engineers Association Meter Engineers' Technical Group. "Tariffs for Electricity Supply," by A. E. Marchant.

Manchester.—Engineers' Club, Albert Square, 7.30 p.m. Junior Institution of Engineers, North Western Section. "Human Relations in the Electricity Supply Industry."

SATURDAY, 9th JANUARY

Hammersmith.—Clarendon Hotel, A.S.E.E. West London Branch. Annual dinner and dance.

Salford.—Peel Park Technical College, 3 p.m. I.E.E. North Western Centre. School-children's lecture. "Colour Television," by Dr. Ing. R. Feinberg.

Street Lighting Notes

Battersea Highways Committee is to improve the lighting of side streets in the borough over a period of seven years. In the first stage of the scheme, mercury vapour colour corrected lighting is to be provided in an area bounded by Battersea Rise, Clapham Common North Side and Silverthorne Road and the Committee has recommended the acceptance of tenders submitted by the Stanton Ironworks Co., the Engineering & Lighting Equipment Co., the Revo Electric Co., and the London Electricity Board.

Castle Ward (Northumberland) R.D.C. has approved a £5,000 scheme for sodium lighting along the A.1 road.

Bournemouth Highways and Works Committee recommends that the replacement of gas street lighting by electric lighting at West Cliff, the town centre and East Cliff should be put in hand as soon as the Westbourne area has been completed. This represents the second stage of the Council's ten-year street lighting conversion scheme.

Further street lighting improvements at **Doncaster** are estimated to cost £23,000.

Blackpool Highways Committee is applying for sanction to borrow £45,873 for completing the Council's scheme for the conversion of street lighting from gas to electricity and the provision of improved lighting in certain roads.

Nelson Corporation is recommended to approve a scheme, estimated to cost £24,000, for the completion of electric street lighting installations in various streets.

Eastbourne Highways and Drainage Committee is to make provision in next year's estimates for improved street lighting in Decoy Drive, Nevill Avenue, Brassey Avenue and Mountfield Road, using 250 W colour-corrected mercury vapour lamps, at an estimated cost of £3,845.

Redcar Corporation is proposing to carry out a further stage of its programme for the conversion of street lighting from gas to electricity at a cost of £8,000.

Prestatyn U.D.C. has approved a scheme, estimated to cost £17,000, for the conversion of street lighting at Meliden from gas to electricity.



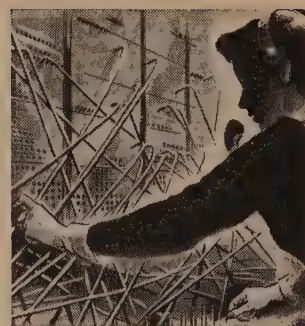
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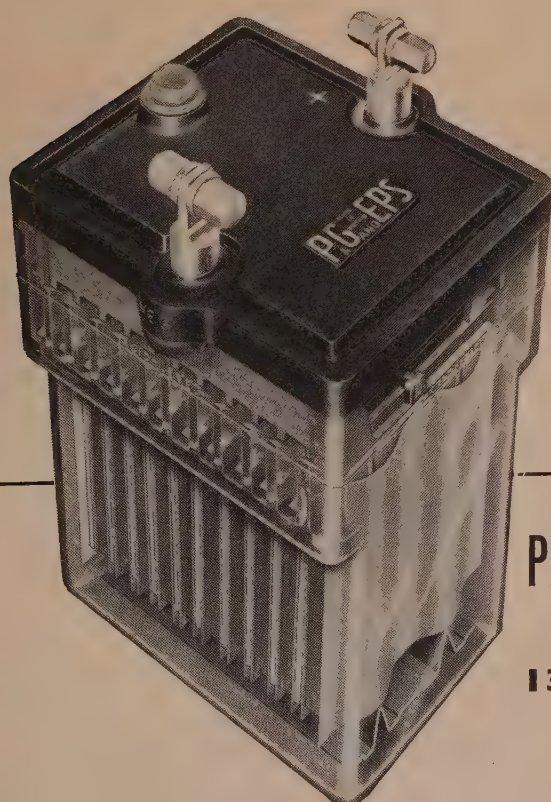
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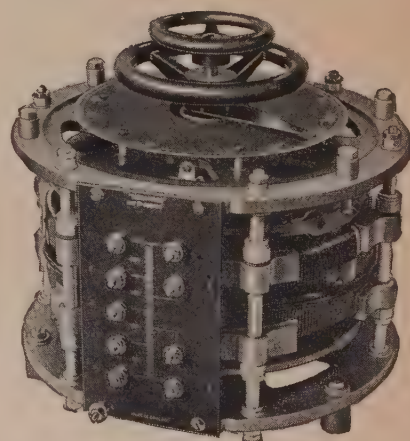
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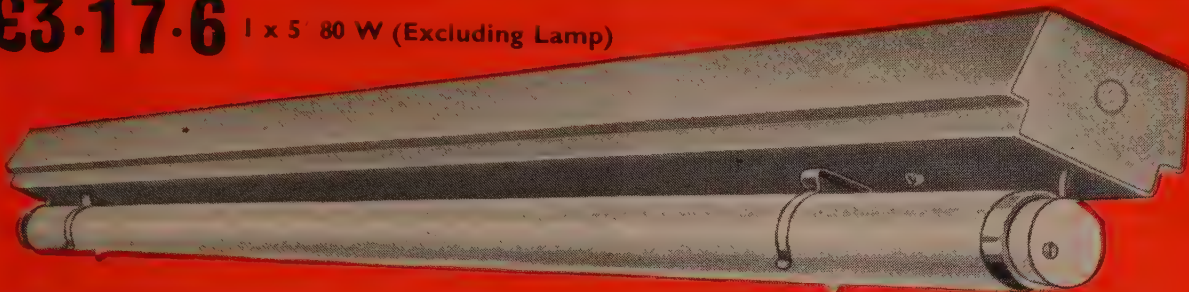
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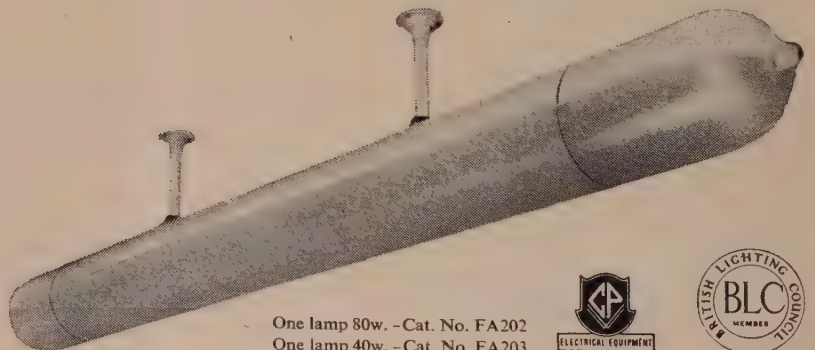
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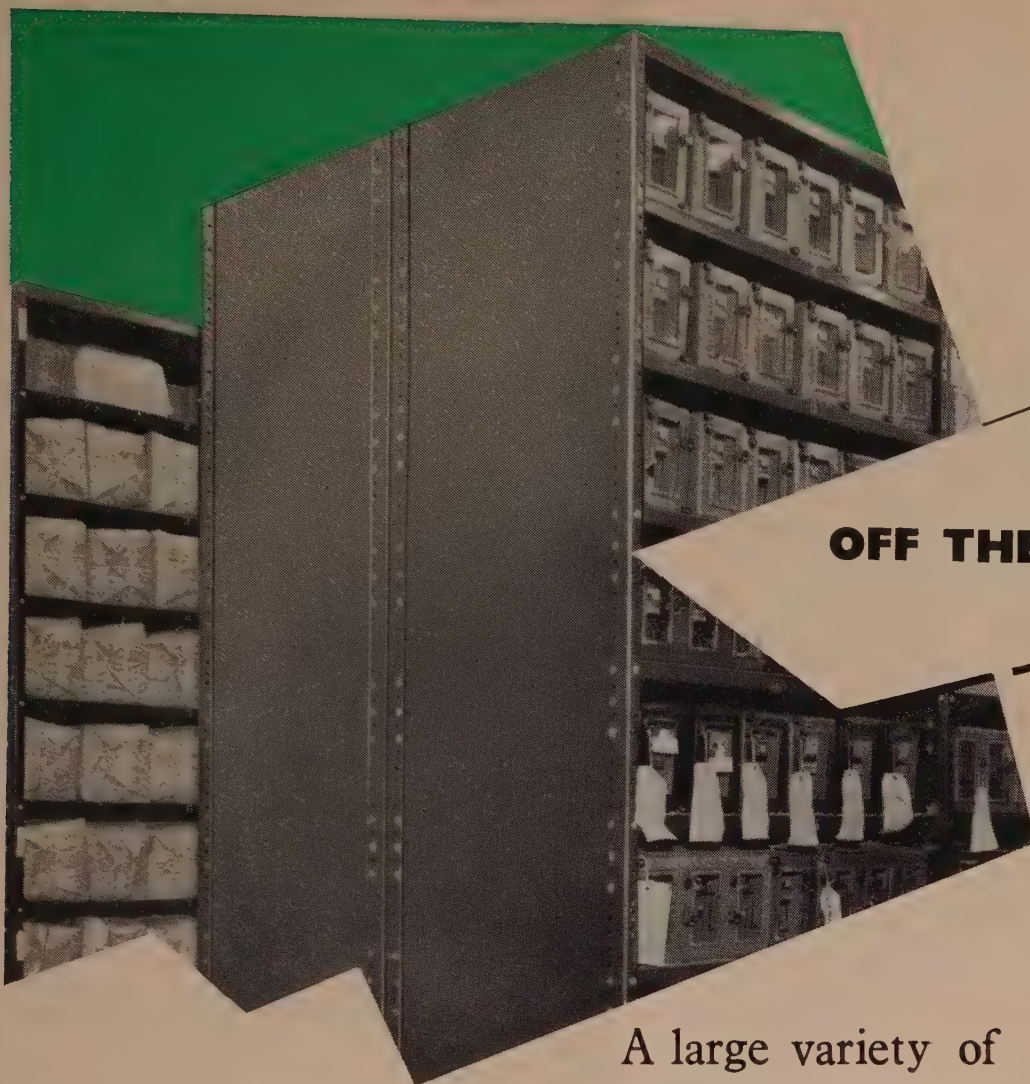
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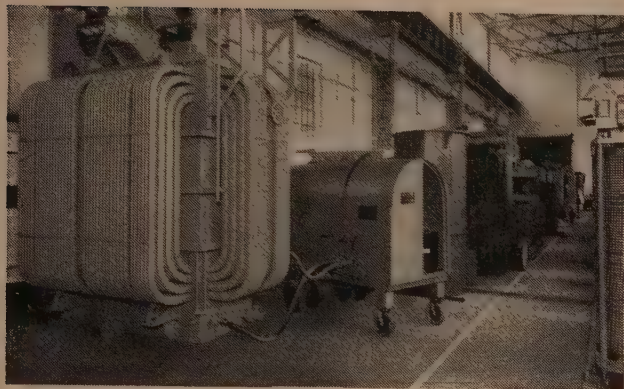
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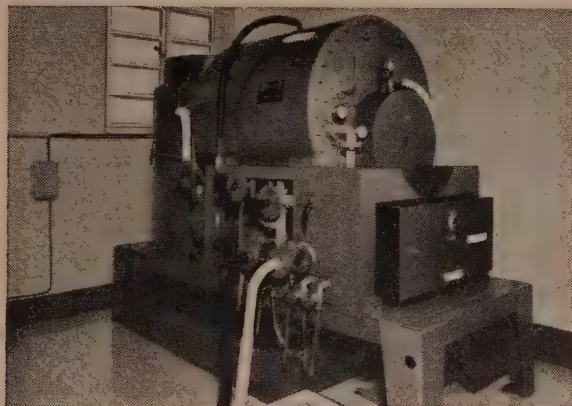


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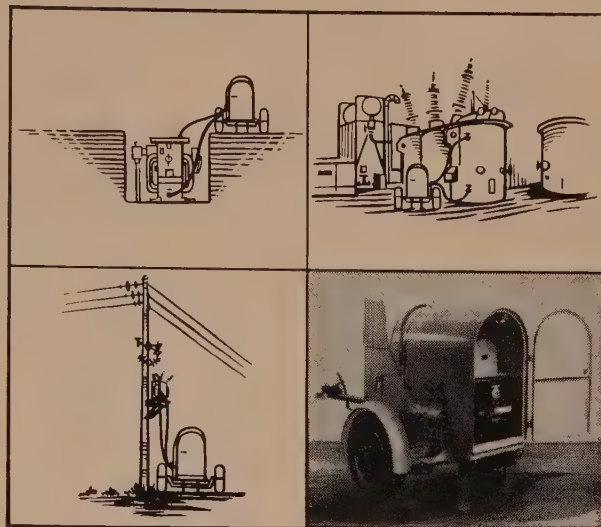
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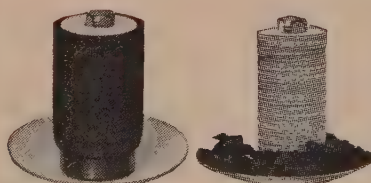
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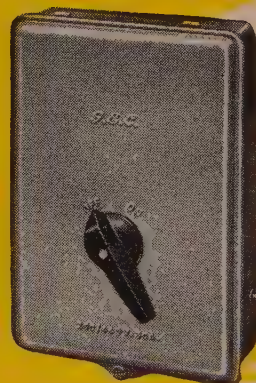
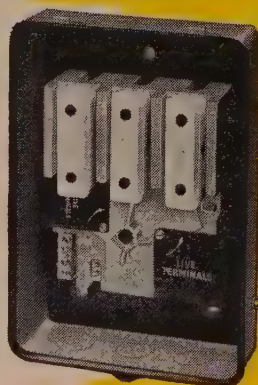
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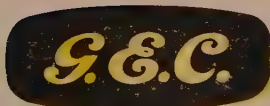
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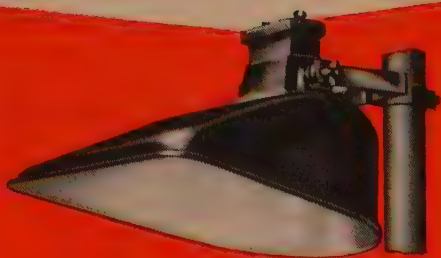
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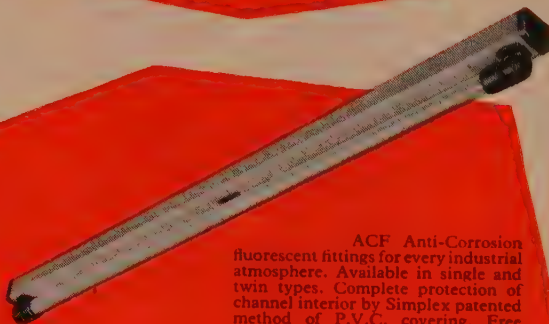
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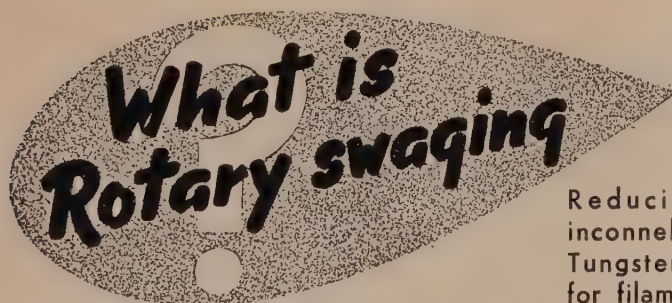
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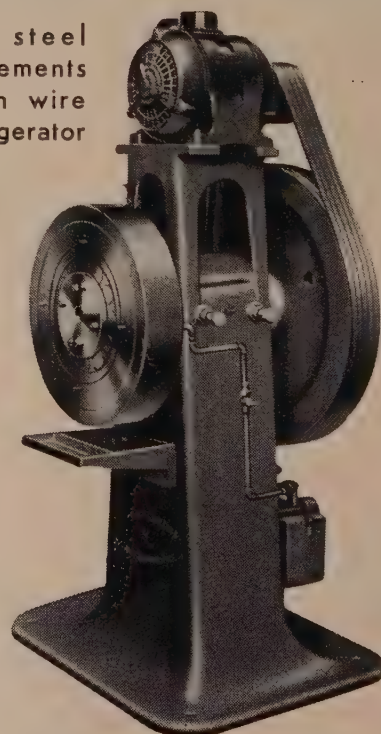
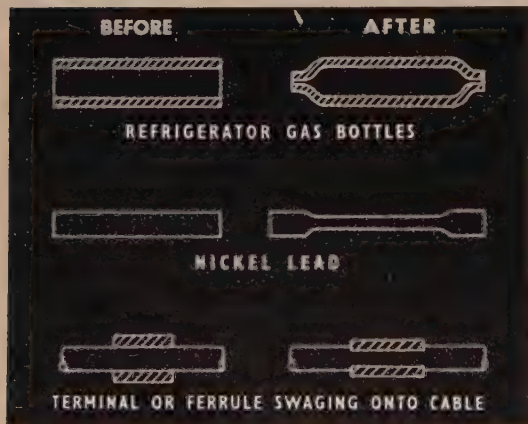


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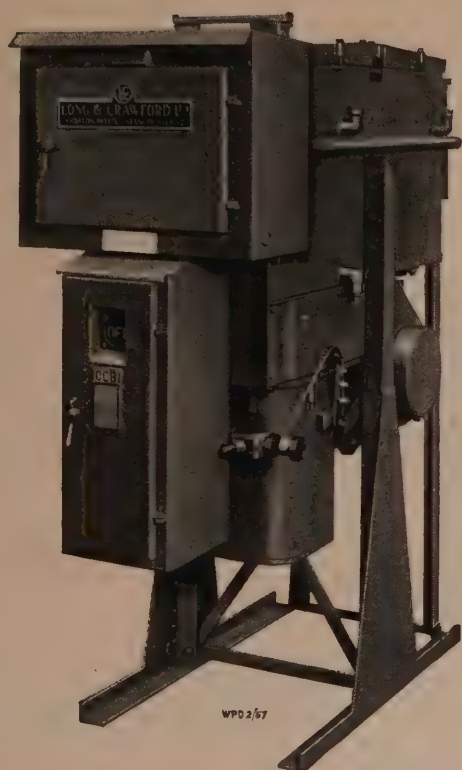
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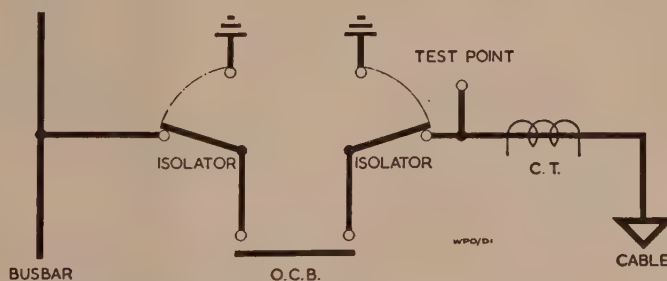
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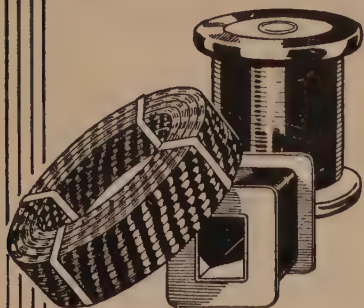
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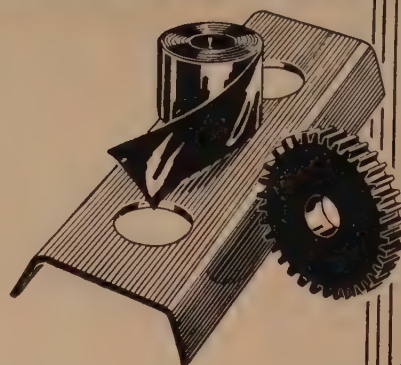
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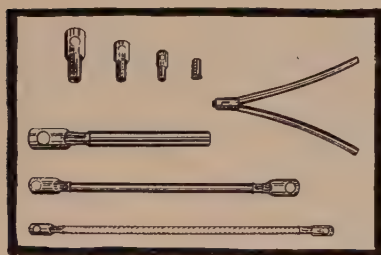
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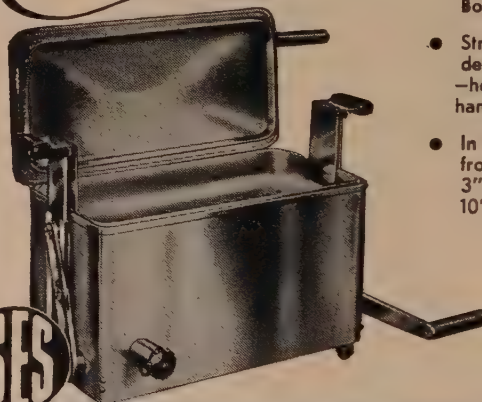
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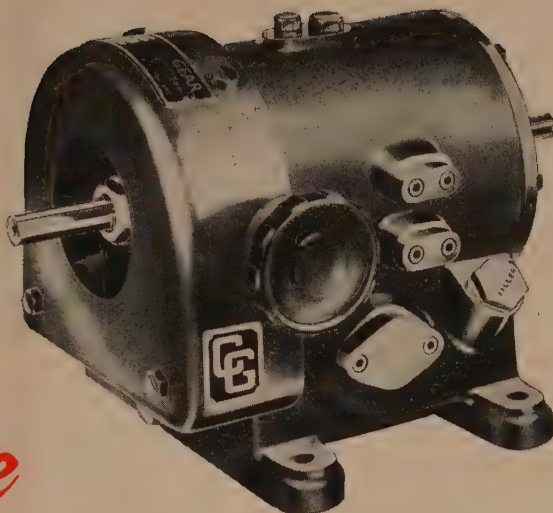
FLUORESCENT LIGHTING EQUIPMENT

CROFTLITE LTD.
15, GODDAGE PLACE, LONDON, W.1
MUSEUM 196/197

LAMPS AND ACCESSORIES

SCALES · DIALS · CALCULATORS · RULES · INSTRUCTION & NAMEPLATES

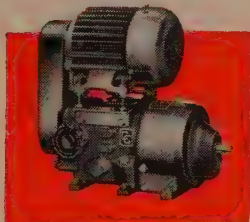
Carter Hydraulic Variable Speed Drives



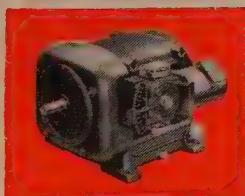
Wide infinitely variable speed range (approximately 27/1 on full load).
Sensitive accurate speed control by Hand, Electrical or Lever arrangements.
Constant output torque throughout the entire variable speed range.
Positive displacement action ensures maximum 'controllability' at all speeds.
Carter Variable Speed Gears may be used to pick up loads from zero r.p.m.
Controls may be operated with the drive either running or stationary.
Made in ten sizes for fractional up to forty horsepower drives.
Flange mounted reduction gears can be supplied for slow speed drives.
Compact, efficient, easy to install and simple to maintain in service.
Entirely self lubricating since oil is the power transmitting medium.

typical drives

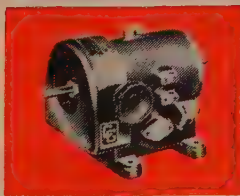
A comprehensive enquiry questionnaire is available which, when completed, will enable our Technical Staff to offer suggestions for the most suitable and economical Carter Variable Speed Drives. To obtain copies of both Enquiry Forms and current technical publications please quote reference 259.



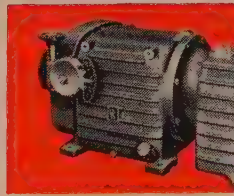
'F' Type Carter Gear with top mounted motor and flange mounted spur reduction gear.



'A' Type Carter Gear with push-button operated Remote Electrical Speed Control.



Fractional horsepower 'F' Type Carter Gear fitted with standard Handwheel Speed Control.



Handwheel controlled 'A' Type Carter Gear with flange mounted spur reduction gear.

Carter Gears Limited

**BRADFORD 3
YORKSHIRE
ENGLAND**



'phone : Bradford 64378 (3 lines)
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- ENGLAND'S LOWEST PRICES!
- OVER 80 MODELS!



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Spotlight Catalogue or visit
our modernised showrooms at:

180 Shaftesbury Avenue, London, W.C.2

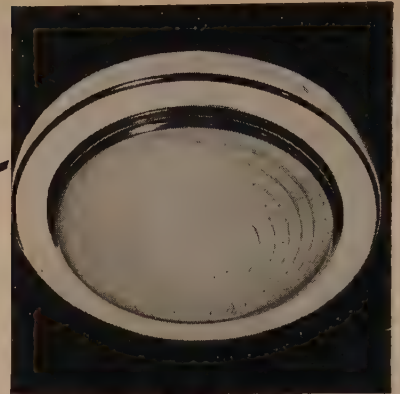
LUMITRON LIMITED

Manufacturers of
contemporary lighting fittings

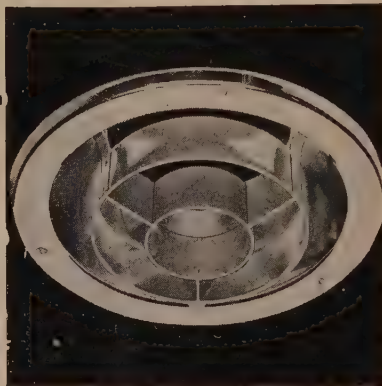
Telephone:
COvent Garden
0126



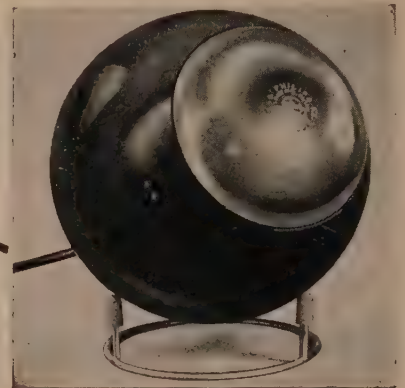
507 SM/BC/100 w — 4 colours — with Louvre
38/-



533/BC/150 w with R5/L brass rim, lens and
mirror finished reflector 74/8 plus 16/2 P.T.

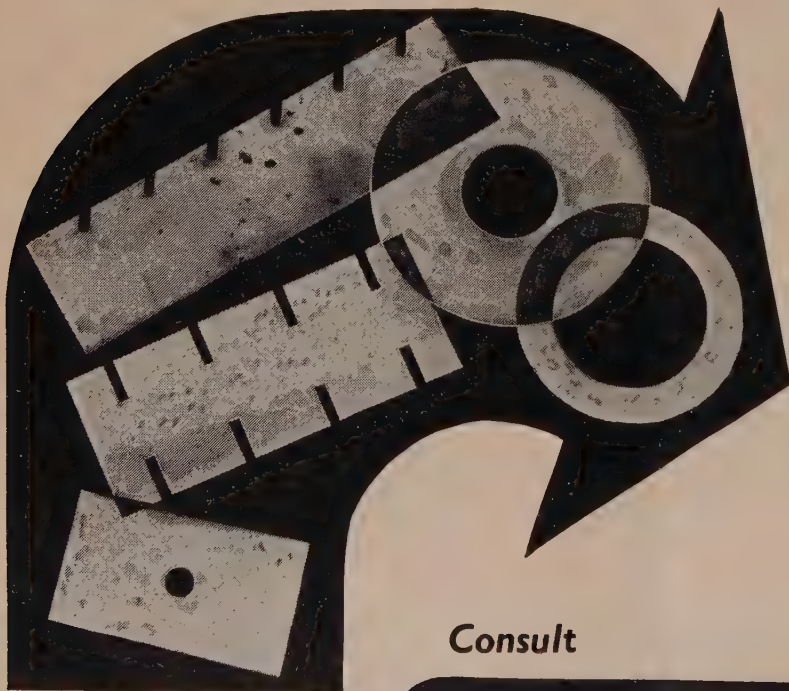


565/BC — mirror finish with Louvre
32/8



509/ES/100 w IS — 3 colours — 6' flex
32/8

Prices shown are retail



for
MICA
INSULATION

Consult

EAST LONDON MICA WORKS

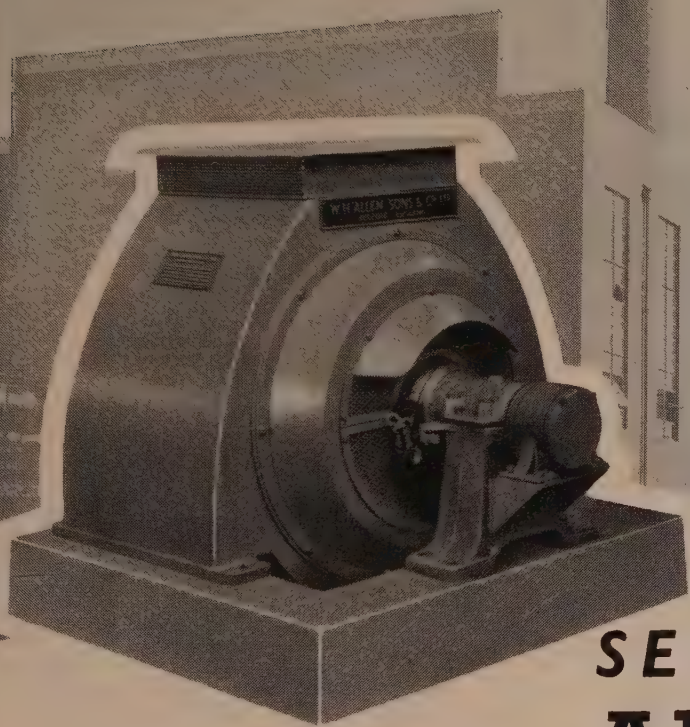
RINGWOOD RD., WALTHAMSTOW, LONDON, E17

ESTD. 1912

Phone:
COPpermill 2248/9

Telegrams:
Elmicmer, Easphone, London

Land or Marine

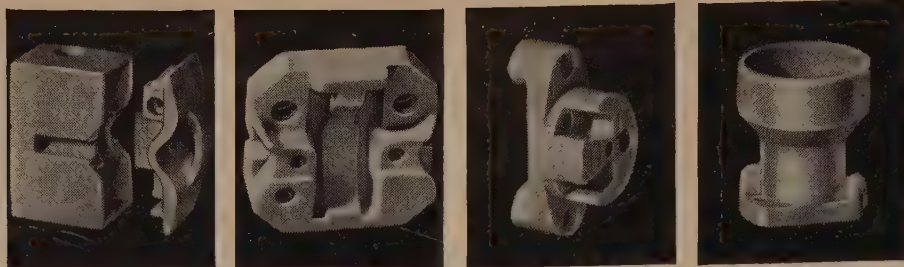


The **ALLEN** **SELF-REGULATING** **ALTERNATOR**

- Completely static excitation and control system : no d.c. exciter, no relays or contactors.
- Steady-state accuracy independent of power factor or temperature ; static automatic trimming control.
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- Positive and reliable excitation initiation system : permanently-connected yet independent of alternator residual magnetism.



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Larger than a man... smaller than a thimble!



Manufacturers and public services cannot afford to experiment with so vital a factor as safety—that is why porcelain is the most widely used insulating material. No substitute combines all the properties of porcelain, for example—

High mechanical strength

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Low initial tooling cost giving flexibility in design.

In B.E.C.M.A. you have at your service the resources, design staffs, technical advisers and testing laboratories of the twelve leading Electro-Ceramic manufacturers.

You cannot beat

PORCELAIN

for insulation



BRITISH ELECTRO-CERAMIC MANUFACTURERS' ASSOCIATION, FEDERATION HOUSE, STOKE-ON-TRENT

D.C. MOTOR PROBLEMS?

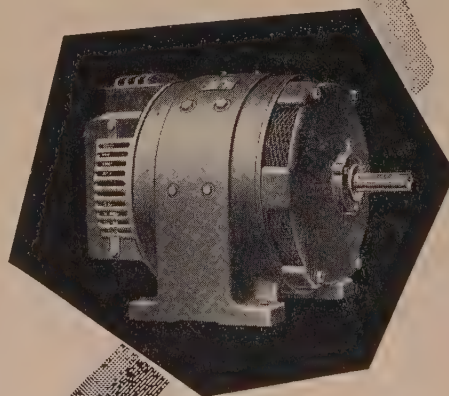
-let E.P.E. solve them
for you quickly

In these days of AC it is not always easy to get DC motors and generators quickly and at a reasonable price. Fortunately, EPE specialise in DC equipment, bringing years of experience to bear on the subject, so that one can always be sure of DC motors and generators, of any enclosure, at competitive prices, on short delivery. EPE are always happy to help solve DC problems, too.

E·P·E

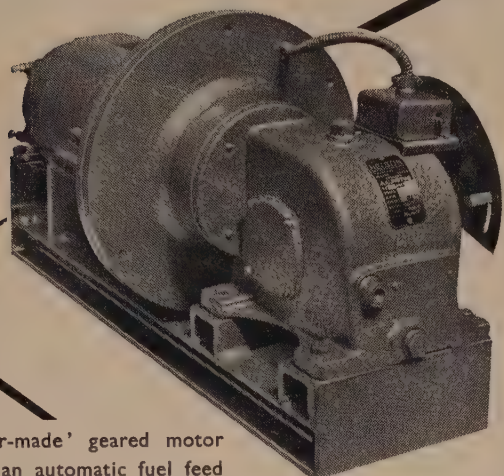
**ELECTRICAL POWER
ENGINEERING CO. (B'ham) LTD.**
Bromford Lane, Birmingham 8

'Phone: SEchford 2261
'Grams: Torque 'Phone Birmingham
London Office: 421, Grand Buildings, Trafalgar
Square, W.C.2. 'Phone: WHitehall 5643 and 7963



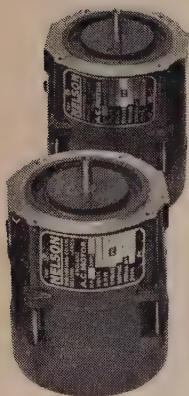
LOW SPEED DRIVE

Geared



This 'tailor-made' geared motor is used in an automatic fuel feed system for furnaces. The motor has an output torque of 200 ft. lbs., a speed of .25 r.p.m. and is fitted with electro-magnetic brake and recovery loss switchgear.

or Gearless



Although strictly non-standard, Nelson Hetropolar Motors are already in quantity production and are being widely specified for indexing, valve control, electronics, etc., where they provide a TRUE low speed drive without the use of reduction gears. C.S.A. approved. Available from $\frac{1}{32}$ to $\frac{1}{4}$ h.p. for the following speeds:-

50 cycles	62.5 r.p.m.
	75.0 r.p.m.
60 cycles	75.0 r.p.m.
	90.0 r.p.m.

THE NELSON ENGINEERING CO. LTD.

limited or quantity production

NELSON

NON-STANDARD

MOTORS

THE NELSON ENGINEERING CO. LTD.
NELSON • LANCASHIRE Nelson 62545/6

HGP/NSM1

**WEATHERPROOF METAL-CLAD
SOCKETS, PLUGS, SWITCH SOCKETS etc.**
for all electrical purposes

NIPHAN

5-300 amp. 250-500 Volt



Plug

C.I. Switch Socket and Cover

Flange Socket with Cover and Plug

Through Angle Flange Socket with Cover and Plug

C.I. Terminal Socket and Cover with through sealing chamber and glands for cable

SIMMONDS & STOKES (NIPHAN) LTD

MANUFACTURING ELECTRICAL ENGINEERS

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RELAY USERS "CORREX" TENSION GAUGES

The only instrument solely designed for accurately measuring tension on Relays, Contacts, Switchgear, and electrical apparatus of all kinds.



Gauge measures in grammes, and a large range of sizes is produced to cover from 0.3-2,000 grammes. Swiss made and guaranteed.

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Telephone: TERMINUS 8866 (P.B.X.)

H.B. TRANSFORMER TAPPING SWITCH TYPE L



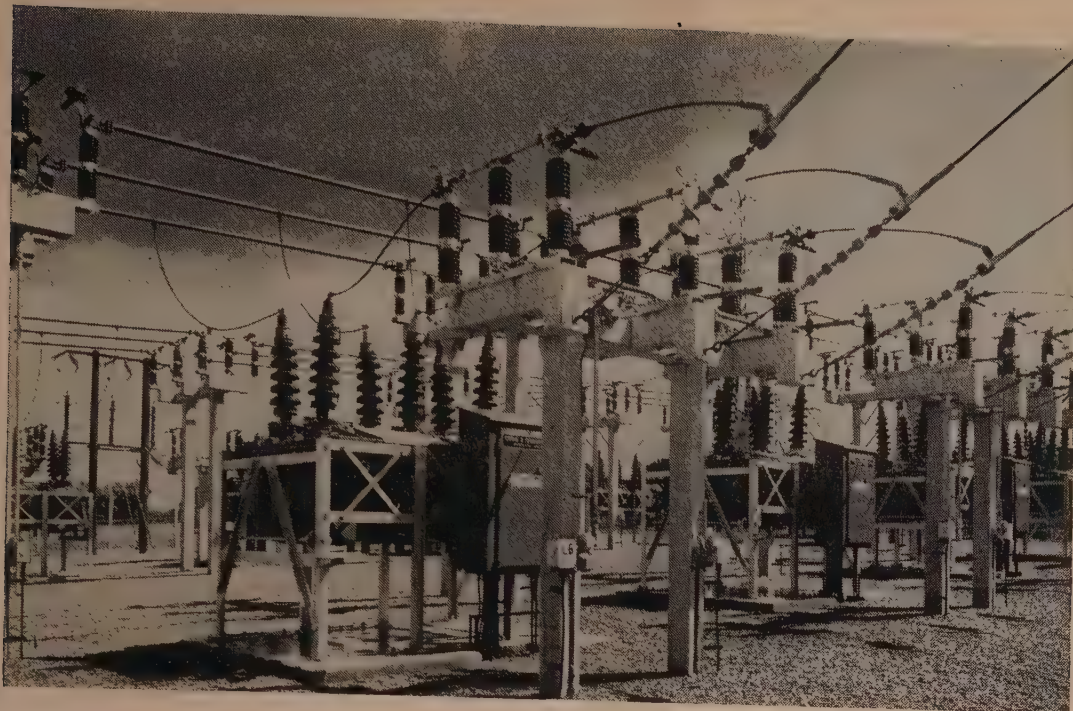
Interlocked with micro break switch

Pull Handle to release Lock, then turn

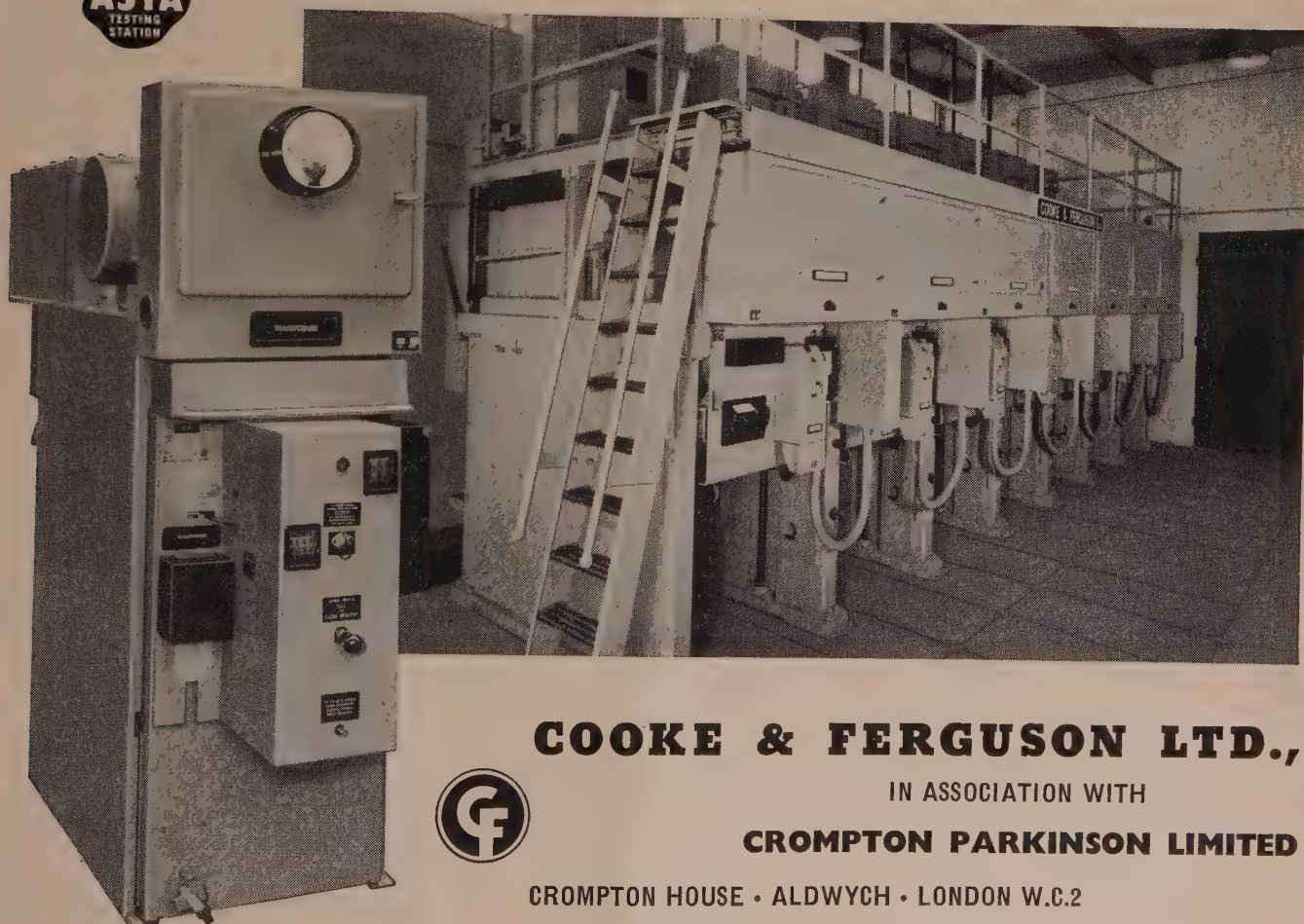
Also Type O without interlock and Type C for on load switching

SINGLE OR MULTI POLE
Phone: Kings Norton 1604

HENLEY BURROWES & CO. LIMITED
Factory Centre: KINGS NORTON, BIRMINGHAM



**For outdoor
or indoor switchgear
up to and including 66kV**



COOKE & FERGUSON LTD.,

IN ASSOCIATION WITH

CROMPTON PARKINSON LIMITED



CROMPTON HOUSE • ALDWYCH • LONDON W.C.2



Weir

DE-AERATORS

eliminate oxygen
corrosion in the
power plant

Prolong life of boiler tubes, economisers, valves and other surfaces.

Heat in operating steam retained in feed water.

The Weir triple De-aerators illustrated are mounted on a feed tank 35 feet long, 12 feet 6 inches diameter, and have a normal output of 1,300,000lb./hr. at 280°F.

We invite enquiries for the most suitable equipment to meet specified requirements.

Weir G. & J. WEIR LTD., CATHCART, GLASGOW, S.4

MERCURY SWITCHES

THE MERCURY SWITCH MANUFACTURING COMPANY LIMITED are the largest specialised manufacturers of Mercury Switches in Great Britain. These are made to exceptionally high and uniform standards of quality.

Since its inception in 1932, this Company has concentrated solely on the production of Mercury Switches. It has thereby obtained the widest possible experience and expert knowledge of design, manufacture and application.



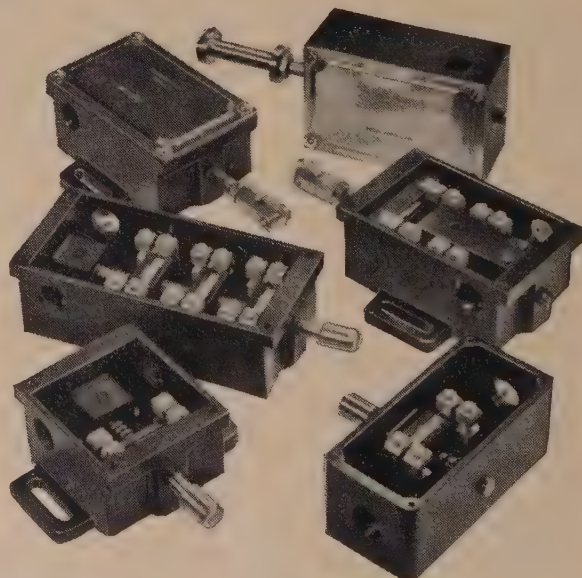
THE MERCURY SWITCH
MANUFACTURING CO. LTD.
WEST DRAYTON - MIDDX.

West Drayton 3157

MS11

"Colne"

HEAVY DUTY LIMIT SWITCHES



Manufactured by

ASQUITH ELECTRICS (Colne) LTD.

formerly Colne Switchgear (K. & W.) Ltd.

Walton Street, Colne, Lancs.

Telephone: Colne 1394/5

'METWAY'

Announce **A NEW ERA!**

BULKHEAD FITTINGS IN BAKELITE



917/PH
918/PH

WELL GLASS FITTINGS IN PORCELAIN



917/5647
918/5648

BULKHEAD FITTINGS

List No.	Size	Diffuser	Each
2682/PH	40 watts	Clear Plastic	10/6
2682/PHR	"	Red Plastic	11/6
2682/PHY	"	Yellow Plastic	11/6
2682/PHG	"	Green Plastic	11/6
2650/PH	60 watts	Clear Glass	9/8
2652/PH	100 watts	" " Without Guard	13/8
2655/PH	"	" " With Guard	13/8
2657/PH	"	" " With Guard	17/8

All Subject to Trade and Wholesale Discounts

WELL GLASS FITTINGS (With Porcelain Tops)

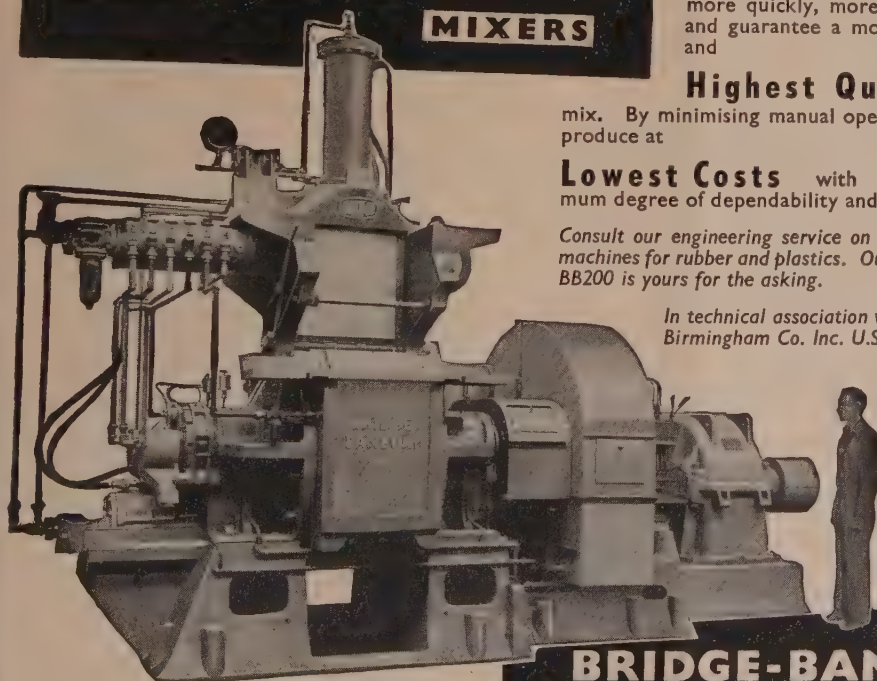
List No.	Size	Each
917/PH	40/60 watts	12/4
918/PH	75/100 watts	17/8
917/PH/SH	40/60 watts	13/4
918/PH/SH	75/100 watts	18/8
917/5647	40/60 watts	16/8
918/5648	75/100 watts	25/4
917/5647/SH	40/60 watts	19/4
918/5648/SH	75/100 watts	26/4

All Complete With Porcelain B.C. Lampholders

Ask for List No. 1859/ER

METWAY • KEMPTOWN • BRIGHTON • ENGLAND

Bridge-Banbury MIXERS



SIZE 11 BRIDGE-BANBURY

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Grams and Cables: "EDERACEO" Piccy London

Produce the

Highest Output

more quickly, more efficiently,
and guarantee a more uniform
and

Highest Quality

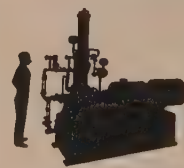
mix. By minimising manual operating they
produce at

Lowest Costs with the maxi-
mum degree of dependability and safety.

Consult our engineering service on layouts and
machines for rubber and plastics. Our catalogue
BB200 is yours for the asking.

In technical association with Farrel-
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BRIDGE-BANBURY
Automation



SIZE 8 BRIDGE-BANBURY



SIZE 3A BRIDGE-BANBURY



SIZE 9 BRIDGE-BANBURY



SIZE 27 BRIDGE-BANBURY

QUICKWAY

Taping machines *SPEEDY*

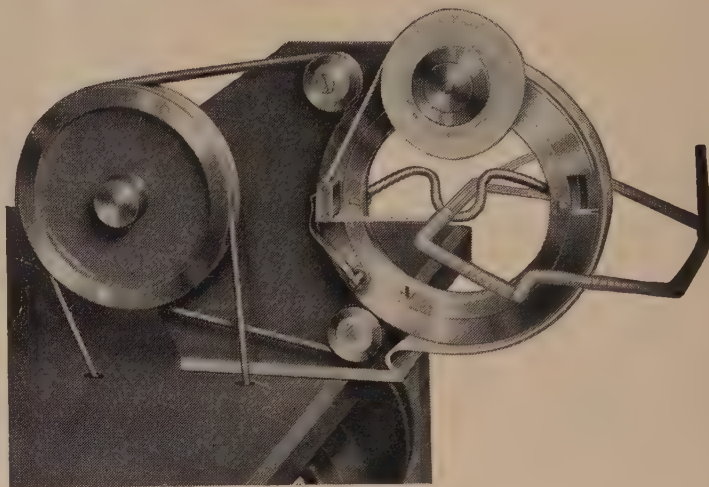
taping for all type coils

Tapes stator and armature coils quickly and neatly. Other applications are the taping of busbars, wiring harnesses, etc.

A necessity for repairs or production, and an ideal companion to a "QUICKWAY" Coilwinding and Forming Machine.

We can offer individual items with the machine such as clutch unit and motor, or a complete arrangement with bench.

Full details on request.



THE MIDLAND DYNAMO CO. LTD.

QUICKWAY WORKS - LEICESTER - Tel. 20172 (5 lines) Grams: "DYNAMO" LEICESTER

REAL

Watertight Protection

Come hail, rain or shine, R.E.A.L. Non-Corrosive Watertight Fittings stand the test of time in any part of the world. There just isn't anywhere in this all-porcelain one-piece fitting where rain or damp of any kind can do damage. Incidentally, it's a matter of seconds to unscrew the well glass to fit a replacement lamp. This is R.E.A.L. saving in time, money and maintenance!

with

REAL

Watertight Fittings

R.E.A.L. is the registered trade mark of
ROWLANDS ELECTRICAL ACCESSORIES LTD., R.E.A.L. Works, Birmingham, 18



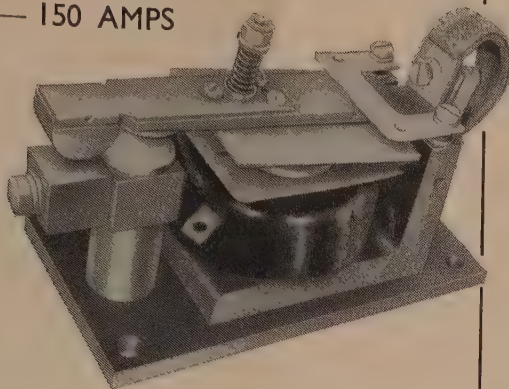
Patent No. 568702

Catalogue No.
P5806 gives details
of all sizes from
60 watt to 500 watt.

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RANGE 50 — 100 — 150 AMPS

**Contact
replacement
minimised
by patented
arcing tip**



Cableform Ltd

ROMILEY CHESHIRE

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Grams: 'Noflash' Romiley

A.I.D. & A.R.B. APPROVED

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Tel.: Macclesfield 4946

OUR MANUFACTURING RANGE INCLUDES—

- Contactor Switchgear
- Sequence Control Gear
- Transformer and Coil Assemblies
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- Commercial Cable Assemblies
- Transformer Rectifier Units
- Terminal Blocks and Wiring Accessories
- Overload Units
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ENBRAY

MOTOR CONTROL GEAR

- AC and DC Contactor Starters
- Industrial or Marine Patterns
- Relays, Timers and Contactors
- Regulators. Hand or Motor operated
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- Robust Design
- Competitive Prices
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London and South — apply Head Office



**Man from Mars
— or a
Radio Robot?**

Neither really, we are glad to say. These are just some of the wide variety of interesting shapes in rubber that we make by moulding and extrusion.

Consult us early in your planning; our technical department is at your disposal for advice on design

**IF IT'S RUBBER — YOU CAN BANK ON
BANK BRIDGE**

BANK BRIDGE RUBBER CO. LTD.

Clayton, Manchester 11 + Telephone: EAST 2041/2

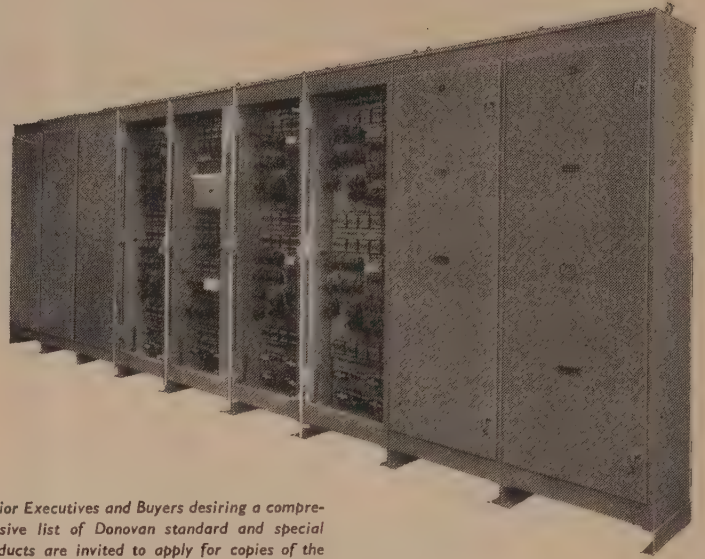


SPECIAL PURPOSE CONTROL PANELS

BY **DONOVAN**

This **SPECIAL** 9-door switchboard controlling a 19 station Metalworking In-Line Transfer Machine may look like any other switchboard **BUT—**

STANDARD-PROVEN Donovan Contactors, Relays, Overloads, Isolators, and accessories, are used throughout and in addition the panels are **plug-in** for quick replacement and maintenance — a **valuable** feature only offered by Donovan.



Senior Executives and Buyers desiring a comprehensive list of Donovan standard and special products are invited to apply for copies of the Donovan Catalogue.

THE DONOVAN ELECTRICAL CO. LTD.

75-82 GRANVILLE STREET, BIRMINGHAM 1

LONDON DEPOT: 148-151 York Way, N.7

GLASGOW DEPOT: 22 Pitt Street, C.2

Sales Engineers available in LONDON • BIRMINGHAM • MANCHESTER • GLASGOW • BELFAST • BOURNEMOUTH



(Above)

Cathode bar, H. C. copper, 14' 2½" long x 8" x ⅝", machined taper from 8" to 3" for distances of 7' 6" and 5' 1" from each end respectively, drilled with eleven ⅜" diameter holes and 12 elongated holes.

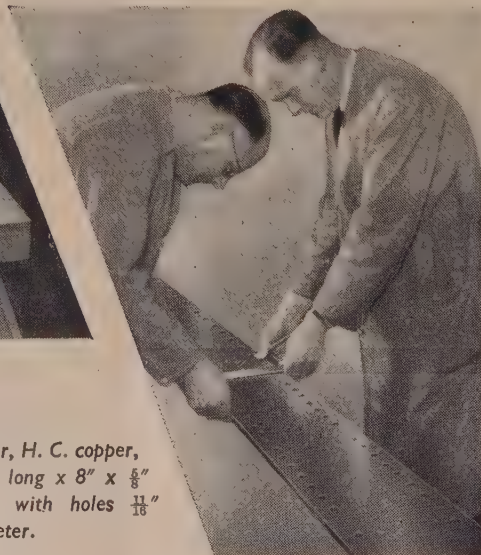
BOLTON'S

H. C. COPPER BUSBARS

Up to 10" wide x 1" thick or 3" square drawn finish; up to 12" x ⅜" x 16' hard rolled; Extra heavy machined bars to customers' requirements. Tubular and laminated busbars.

Pre-assembly work on copper busbars

Facilities are available in our Works for bending, sawing, drilling, slotting, and tinning to customers' requirements.



(Right)

Anode bar, H. C. copper, 14' 5½" long x 8" x ⅝" drilled with holes ⅜" diameter.

THOMAS BOLTON & SONS LTD

Head Office:
Mersey Copper Works,
Widnes, Lancashire
Telephone: Widnes 2022

London Office and Export Sales
Department:
168 Regent Street, W.1
Telephone: Regent 6427
Cables: Wiredrawn, London



Established 1783

Classified Advertisements

CLASSIFIED advertisements are PREPAID at 3/6 per line (approx. 6 words) per insertion. Where an advertisement includes a Box Number there is an additional charge of 1/-.
DISPLAYED CLASSIFIED:—48/- per inch. Cheques and Postal Orders should be crossed and made payable to **ELECTRICAL REVIEW PUBLICATIONS LTD.**

SERIES DISCOUNTS for consecutive insertions:—13, 5%; 26, 10%; 52, 15%.
SITUATIONS WANTED:—Three insertions under this heading can be obtained for the price of two if ordered and prepaid with the first insertion.

REPLIES TO BOX NUMBERS should be addressed to the Box Number in the advertisement, c/o **ELECTRICAL REVIEW**, Dorset House, Stamford Street, London, S.E.1. If an applicant for a situation appearing under a Box Number does not wish his reply to be forwarded to a particular firm or individual instructions to this effect should be addressed to the Advertisement Supervisor, **ELECTRICAL REVIEW**. The name of an advertiser using a Box Number cannot be disclosed.

OFFICIAL NOTICES, TENDERS, ETC.

The Restrictive Trade Practices Act, 1956

IMPORTANT NOTICE

1. Following upon the registration of the Agreement between the members of the **NATIONAL FEDERATED ELECTRICAL ASSOCIATION** (The Association) pursuant to provisions in the above Act, the Registrar of Restrictive Trading Agreements (The Registrar) has informed the Association that in accordance with his statutory obligations he will shortly be instituting proceedings in respect of the Agreement before the Restrictive Practices Court pursuant to Section 20 (2) (a) of the Restrictive Trade Practices Act, 1956. The proceedings will probably have been instituted by the issue of a Notice of Reference by the time this Notice goes to print.

2. In the ordinary course of these proceedings the Registrar would make each of the members of the Association, as well as the Association itself, a Respondent (that is, a party to the proceedings) to the Notice of Reference.

3. However, where, as in the case of the Association, a numerous class of persons has a common interest in the proceedings, the Registrar can apply to the Court for an Order directing a member of the class to represent in the capacity of a Representative Respondent throughout the proceedings, all or some of the parties thereto.

4. The Registrar has indicated to the Association that he would be willing in this case to make such an application to the Court.

5. The Association has given very full consideration to its own position and to the position of its members in these circumstances, and has decided to conduct a vigorous defence of its present arrangements. Furthermore, discussions have taken place between representatives of the Association and the Treasury Solicitor at which the Registrar has been invited to apply to the Court for an Order appointing the National Federated Electrical Association to represent all its members as Representative Respondent in these proceedings. The Association, of course, recognises that it is open to every person proposed to be represented by it, to object to such representation, and to appear separately as a Respondent to a Notice of Reference served on him by the Registrar, and to conduct his own case independently of the Association. However, the Association considers that it is in the best interest of all persons concerned to leave it to the Association to justify its arrangements in both a Representative and in its own capacity, because it would cause difficulties for each member to appear separately and it would facilitate the conduct of the proceedings, save expense and also assist the Court if the Association be authorised to represent all its many members.

6. ACCORDINGLY, AN APPLICATION AS DESCRIBED ABOVE WILL, IT IS UNDERSTOOD, BE MADE BY THE REGISTRAR WITHIN ABOUT A FORTNIGHT OF THE PUBLICATION OF THIS NOTICE. IF THE COURT DECIDES TO MAKE A REPRESENTATION ORDER IN THE TERMS SOUGHT BY THE REGISTRAR, THEN A FURTHER NOTICE WILL APPEAR IN THESE PAGES, SETTING OUT SHORT PARTICULARS OF THE NOTICE OF REFERENCE AND ALSO OF THE REPRESENTATION ORDER GRANTED BY THE COURT.

7. IF ANY INDIVIDUAL MEMBER OBJECTS TO BEING REPRESENTED BY THE ASSOCIATION IN THE PROCEED-

INGS AND WISHES TO APPEAR BEFORE THE COURT EITHER IN PERSON OR BY HIS OWN COUNSEL HE SHOULD HIMSELF, OR THROUGH HIS SOLICITOR, NOT LATER THAN THE 14TH JANUARY, 1960, INFORM BY LETTER THE SOLICITOR TO THE REGISTRAR, THE TREASURY SOLICITOR, RESTRICTIVE TRADE PRACTICES BRANCH, CHANCERY HOUSE, CHANCERY LANE, LONDON, W.C.2, OR THE SOLICITORS TO THE ASSOCIATION, MESSRS. WITHERS & CO., OF 4, ARUNDEL STREET, STRAND, LONDON, W.C.2, OF HIS OBJECTION.

2727

AYR COUNTY COUNCIL

Hurlford Trunk Road Lighting: Extension Ayr and Prestwick By-Pass Road: Roundabout Lighting

THE County Council will shortly issue separate Schedules in connection with each of the above installations. Schedules will cover:—

1. Supply of concrete standards.
2. Supply of electrical equipment.
3. Work of erection.
4. Supply of lanterns for 140-w. SO/H lamps.

Contractors to indicate to Water and Drainage Engineer, County Buildings, Ayr, in which contracts they are interested.

Any attempt to interlink conditionally the schedules will constitute automatic disqualification.

The County Council is not bound to accept the lowest or any offer.

IVIE McCAIG,
County Clerk. 2745

INDIA SUPPLY MISSION

THE Office of India Supply Mission, 2536, Massachusetts Avenue, N.W. Washington, 8, D.C., United States of America, invites tenders for the following:—

TENDER ENQUIRY No. SE.130.

For the supply of Two 30,000-kW Steam Turbo-Alternators complete with condensers, feed water heaters, etc., required by the Madhya Pradesh State Electricity Board for Amar Kantak Thermal Power Station.

Specifications, etc., relative to the above specification can be obtained from the Co-ordination Branch, India Store Department, Bromyard Avenue, Acton, London, W.3, at a cost of £1 15s. 8d. per tender, and is not refundable. Tenders are to be returned direct to India Supply Mission, 2536, Massachusetts Avenue, N.W. Washington, 8, D.C., United States of America, so as to reach them by 17th February, 1960.

Specimen copy of the above enquiry can be seen at India Store Department, Engineering Branch, Bromyard Avenue, Acton, London, W.3, under the following reference: S.3734/59/NSC/ENG.2. 2728

BOROUGH OF LUTON

TENDERS invited for erection and wiring only of 440 Class "B" Concrete Lighting Columns with Sodium Discharge Lighting.

Documents from Borough Engineer, Town Hall, Luton, on payment of £2 2s. deposit, returnable after receipt of a bona fide tender not subsequently withdrawn. Cheques payable to "Luton Corporation." Tenders to Town Clerk, Town Hall, Luton, by noon on 28th January, 1960. 2746

Advertisements are accepted up to first post on Monday of the week of issue

If displayed with boxed rules, name or symbol block by Friday prior to week of issue

All communications to be addressed to:
Classified Advertisement Department,
ELECTRICAL REVIEW
Dorset House, Stamford Street
London, S.E.1

Original testimonials should not be sent with applications for employment

CITY AND COUNTY BOROUGH OF BELFAST

Electricity Department

STORES

TENDERS are invited for the supply of the undermentioned materials during 12 months commencing 1st May, 1960:—

Form No.

1. Turbine Oil.
2. Transformer Oil.
3. Firebricks, Fireclay, Binding Cement for High-temperature Fire Requirements.
5. Carbon Brushes.
6. Steel Wire Ropes.
8. Glazed Stoneware Ducts, Troughing, Pitch Fibre Conduits and Covering Tiles.
9. A.C. Distribution and Street Lighting Control Pillars.
10. 6.6-kV Indoor Metalclad Switchgear.
11. Meters, Instrument Transformers and Ancillary Equipment.
12. Electricity Maximum Demand Indicators.
13. Time Switches.
14. L.T. Fuse Units, Service Cut-outs and Accessories.
15. Distribution Transformers.
18. Electric Washboilers.
19. Electric Kettles.
21. Electric Cookers.

Forms of tender may be obtained from the Electricity Department, East Bridge Street, Belfast, 1, on payment of the sum of Ten Shillings (non-returnable) for each form. Extra copies of the forms may be obtained at Five Shillings each (non-returnable). Cheques should be made payable to the Belfast Corporation Electricity Department.

All letters, catalogues, drawings, etc., accompanying tenders must be submitted in duplicate.

Tenderers are advised that the Corporation Conditions of Contract only will apply. Any other conditions put forward by tenderers will not be accepted.

Tenders, in sealed envelope marked "Tender for Stores, Electricity Committee," and endorsed with the name and address of the firm tendering, must reach the undersigned not later than 4 p.m. on Friday, 22nd January, 1960.

An official receipt must be obtained for each tender delivered by hand. Tenders sent by post should be registered.

The lowest or any tender will not necessarily be accepted.

JOHN DUNLOP,
Town Clerk.

P.O. Box 234,
City Hall, Belfast.
15th December, 1959. 2747

HERTFORDSHIRE COUNTY COUNCIL

THE HERTFORDSHIRE COUNTY COUNCIL invite applications for inclusion on their List of Contractors for building and maintenance works, heating and electrical works, fencing works, etc. Tenders will normally be invited from a number of firms on the list, but the County Council reserve the right to ask for other tenders.

Application forms from the Clerk of the County Council, County Hall, Hertford.

Contractors who have already applied for inclusion on the list need not apply again.

2782

Official Notices (continued)

BASILDON URBAN DISTRICT COUNCIL

Lighting Installation to Offices:
Block J.1, Basildon New Town Centre

TENDERS will shortly be invited for the design and installation of an office lighting scheme for the second and third floors of Block J.1, Town Centre, Basildon, which is shortly to be occupied by the Basildon U.D.C.

Experienced electrical contractors wishing to tender should apply for documents to the Engineer and Surveyor, 108, High Street, Billericay, Essex, not later than 8th January, 1960, enclosing a two-guinea deposit, which will be refunded on receipt of a bona fide tender, not subsequently withdrawn, or the return of all documents. 2762.

SITUATIONS VACANT

(See "Replies to Box Numbers" on page 87)

SOUTH EASTERN ELECTRICITY BOARD

SENIOR DRAUGHTSMAN (Engineering), Dorking and Epsom District.

Salary within the range £790-£890 under Schedule D, Grade 5 of the N.J.B. Agreement. 38-hour week with three Saturdays out of four free. Generous holiday and sick pay allowance. Applicants with suitable engineering qualification must be capable of taking charge of a drawing office and have experience in the preparation of substation site plans and layouts in addition to mains records and general drawing office routine.

Applications, quoting ER and naming two referees, on forms from District Manager, SEEBOARD, 56, South Street, Dorking, by 13th January, 1960.

THIRD ASSISTANT DISTRICT ENGINEER, Crawley and Horsham District.

Salary £860-£905 p.a. under N.J.B. Class F, Grade 8. Applicants should be suitably qualified and have had training and experience in the construction, operation and maintenance of underground and overhead distribution systems up to 33 kV. The successful applicant will be required to reside within the district and undertake standby duties. Subject to certain conditions, housing accommodation may be available at Crawley.

Applications, quoting ER and naming two referees, to District Manager, SEEBOARD, 50-52, The Broadway, Crawley, by 13th January, 1960.

ASSISTANT DISTRICT COMMERCIAL ENGINEER (Contracting), Dorking and Epsom.

Salary £910-£955 p.a. under N.J.B. Class F, Grade 7. To be responsible to the District Commercial Engineer for the running of a contracting department within the district and for commercial development generally. Applicants should preferably hold a qualification leading to Graduate Membership of the Institution of Electrical Engineers and have experience in all aspects of electrical installation and service work.

Applications, quoting ER and naming two referees, on forms from District Manager, SEEBOARD, 56, South Street, Dorking, Surrey, by 13th January, 1960.

ASSISTANT DISTRICT ENGINEER, Sutton District.

Salary £765 × £15 to £810 per annum plus London allowance under N.J.B. Class G, Grade 11. Superannuable. Applicants should possess the H.N.C. in Electrical Engineering and have had a thorough training in underground and overhead distribution systems.

Applications, quoting ER and naming two referees, on forms from District Manager, SEEBOARD, 52, High Street, Sutton, Surrey, by 13th January, 1960.

ASSISTANT DISTRICT ENGINEER, Croydon and Purley District.

Salary £1,145 × £25 to £1,220 per annum, including London Area allowance under N.J.B. Class J, Grade 7. Applicants must have responsible experience in the design, construction and maintenance of extensive modern street lighting installations.

Applications, quoting ER and naming two referees, on forms from District Manager, SEEBOARD, Electric House, Wellesley Road, Croydon, by 13th January, 1960.

GEORGE WRAY,

Secretary. 2766



M.K. ELECTRIC LIMITED

invite applications for position of

ASSISTANT HOME SALES MANAGER

Applicants must have a good education and preferably a thorough knowledge of the marketing and distribution of Electrical Accessories. Previous experience as a Sales Representative is essential as well as experience in general Sales administration.

The position is permanent and pensionable and offers excellent future prospects.

Application giving full particulars of past experience, age and salary required will be treated in strict confidence if addressed to the

Home Sales Manager, M.K. Electric Ltd., Shrubbery Road
Edmonton, London, N.9

2734

CENTRAL ELECTRICITY
GENERATING BOARD

North Eastern Division

Appointment of Second Assistant Engineer,
Electrical Measurements Section,
Technical Department

APPPLICATIONS are invited for the appointment of a **SECOND ASSISTANT ENGINEER** in the Electrical Measurements Section of the Technical Department with headquarters at Darlington. It is intended that the successful candidate shall be promoted to Senior Assistant Engineer, Grade 3, and take charge of the Section when the present Section Head retires in 1960.

Candidates should have a sound theoretical knowledge of electrical measurements and be Corporate Members of the Institution of Electrical Engineers. Responsible experience in a standardising laboratory and in the application of integrating meters and indicating instruments to large high-voltage circuits is required. Experience in the design of precision integrating meters and instrument transformers would be an advantage.

The salary for this appointment (which is superannuable) will be in accordance with the National Joint Board Agreement, Schedule B, Grade 4, £1,180-£1,410, and will commence at a point commensurate with qualifications and experience.

Forms of application may be obtained from any office of the Board or from Divisional Administrative Officer, Central Electricity Generating Board, North Eastern Division, Carlisle House, Newcastle upon Tyne, 1, to whom they should be returned to arrive not later than 14th January, 1960. 2769

DIELECTRICS

AN enthusiastic young electrical engineer or physicist required to undertake interesting experimental work on dielectrics and to be responsible for laboratory engaged upon control testing of same.

Minimum qualifications: H.N.C., University or Institution graduate preferred. Recent graduates will be considered.

Situated in South-East England, the position is permanent, pensionable, and carries a four-figure starting salary.

Write, stating age, qualifications and experience, to Box 2765.

CENTRAL ELECTRICITY
GENERATING BOARD

Eastern Division

APPPLICATIONS are invited for the following appointment:—

STATION SHIFT CONTROL ENGINEER/
SHIFT CHARGE ENGINEER,
GOLDINGTON GENERATING
STATION/BEDFORD GENERATING
STATION.

Salary N.J.B. Class H, Grade 10, £860 × £15 to £905 per annum plus 10% shift allowance.

Applicants should have reached at least the standard of Ordinary National Certificate in Electrical Engineering, or its equivalent, have experience in the operation of high-voltage switchgear, including protective systems. Experience in the operation of steam generating station plant will be an advantage.

The duties of the successful applicant will include shift duty on a rota acting as Shift Charge Engineer at Prebend Street Generating Station, Bedford.

Forms of application (AE.6/ACT) may be obtained from any Divisional Office of the Board and should be addressed to the Controller, Central Electricity Generating Board, Eastern Division, West Farm Place, Chalk Lane, Cockfosters, Barnet, Herts, to arrive not later than 9th January, 1960, and quoting reference 2/11125.

W. N. C. CLINCH,

Controller. 2770

STATION SUPERINTENDENTS

required by SIERRA LEONE GOVERNMENT Electricity Department on contract for two tours of 18/24 months each in first instance. Gross salary according to experience up to maximum in scale £966 rising to £1,359 a year. Gratuity at rate 15% of total salary drawn. Outfit allowance £60. Children's allowance £48/£288 a year. Free passages for officer, wife and three children under 18 years. Liberal leave on full salary.

Candidates, preferably between 21-40 years of age, must have served full apprenticeship with an electrical engineering company and have had several years' experience of operation and maintenance of power stations in a responsible position. They should preferably hold M.O.T. Certificate (Steam and Diesel) or equivalent. Good knowledge of power station electrical equipment desirable.

Write to the Crown Agents, 4, Millbank, London, S.W.1. State age, name in block letters, full qualifications and experience, and quote M2A/50789/EF. 2753

ROYAL NAVAL SCIENTIFIC SERVICE

SENIOR SCIENTIFIC OFFICERS and SCIENTIFIC OFFICERS required in following localities:—

LONDON AREA: MECHANICAL ENGINEER with sound knowledge of basic principles of thermo and fluid dynamics to carry out research programme in particular field of applied hydrodynamics. Experience in modern methods of design and research on axial flow compressors, turbines or pumps an advantage. MECHANICAL ENGINEER for research on precision gear design. MECHANICAL ENGINEER for work on propulsion problems. APPLIED MATHEMATICIAN for research of basic nature on stability of underwater vehicles; knowledge of theoretical hydrodynamics and theory of control mechanisms an advantage. APPLIED MATHEMATICIAN or THEORETICAL PHYSICIST for acoustic analysis. APPLIED MATHEMATICIAN for work with electronic computers, with special reference to research into general underwater physical problems. ELECTRONIC PHYSICISTS for data handling and analysis problems. EXPERIMENTAL PHYSICIST for research in underwater acoustics. PHYSICIST interested in operation performance. CLASSICAL PHYSICISTS.

BALDOCK: PHYSICISTS or APPLIED MATHEMATICIANS for research in Metal or Quantum Physics.

PORTSMOUTH: PHYSICISTS with experience in field of microwave techniques. ELECTRONIC/ELECTRO-MECHANICAL ENGINEERS (experience in servo-mechanisms an advantage).

HASLEMERE: ELECTRONIC ENGINEER.

PORTLAND: PHYSICISTS or APPLIED MATHEMATICIANS for research in underwater acoustics. PHYSICISTS (general). ELECTRICAL ENGINEERS with advanced electronic design experience. MECHANICAL ENGINEERS. PHYSICAL CHEMISTS.

POOLE: CHEMICAL ENGINEERS. CHEMISTS with experience in rubber technology.

ROSYTH: MECHANICAL ENGINEER with experience in welding development. ELECTRONIC PHYSICISTS.

Candidates must normally be natural-born British subjects of natural-born British parents, with First or Second Class Hons. Degrees or equivalent qualifications. S.S.O.s must have had three years' postgraduate experience and be not less than 26 years of age.

Salaries (men): S.S.O. £1,233-£1,460; S.O. £655-£1,150 (London); somewhat lower in Provinces. Appointments unestablished (with F.S.S.U. benefits), but opportunities may occur for those under 32 to compete for established posts.

Forms from M.L.N.S., Technical and Scientific Register (K), 26, King Street, London, S.W.1 (quote A.483/9A). 259

CENTRAL ELECTRICITY GENERATING BOARD

East Midlands Division

GENERAL ASSISTANT ENGINEER (Chemist), CASTLE DONINGTON POWER STATION (Vacancy No. 230/59).

Applications are invited for the post of General Assistant Engineer (Chemist) at Castle Donington Power Station. Candidates must have had a sound technical training and previous laboratory experience and should preferably hold the Higher National Certificate in Chemistry, but consideration will be given to candidates studying for that qualification.

The salary will be in accordance with Schedule A of the National Joint Board Agreement and will be within the range £560-£700 per annum.

This appointment will be pensionable under the terms and conditions of the Electricity Supply (Staff) Superannuation Scheme.

Applications should be submitted on the official form AE6/ACT, which may be obtained from the Divisional Establishments Officer, Central Electricity Generating Board, East Midlands Division, P.O. Box 25, Barker Gate, Nottingham, and should be returned to the undersigned by 15th January, 1960. PLEASE QUOTE VACANCY NUMBER.

O. S. WOODS,
Divisional Controller.

2748

EASTERN ELECTRICITY BOARD

Essex Sub-Area
(253/59.R)

Demonstrator, South West Essex District

CANDIDATES should have had domestic science training, including electrical housecraft, should preferably hold the E.A.W. Certificate and be competent to plan and give cookery demonstrations, including lectures, and advise consumers on the use of domestic electrical appliances.

Salary N.J.C. Grade 1 (£525-£625), plus London allowance, although progress beyond £565 will be subject to a certificate that the person concerned is capable of undertaking all the duties of the grade.

The successful candidate will be required to contribute to a superannuation scheme and may be required to undergo a medical examination.

Apply by letter to W. T. Langfield, A.M.C.T., A.M.I.E.E., A.I.Mech.E. Manager, South West Essex District, Eastern Electricity Board, Ashton Road, Harold Hill, Nr. Romford, Essex, by 15th January, 1960. 2776

SOUTH OF SCOTLAND ELECTRICITY BOARD

Ayrshire Area

APPLICATIONS are invited for the post of SECOND ASSISTANT DISTRICT ENGINEER in the Mauchline District of this Area.

Applicants should preferably be Chartered Electrical Engineers and have had an extensive training with experience in overhead and underground systems up to 33 kV, including the operation and maintenance of H.V. and L.V. switchgear, a knowledge of protective gear and fault location.

The salary for the post, which is superannuable, will be in accordance with the National Joint Board Agreement, Schedule A, Class B, Grade 7, £860/£905 per annum.

A house can be made available to the successful applicant.

Applications on the standard form should be returned duly completed with any additional information to Mr. G. F. Moore, Manager, Greenholm Street, Kilmarnock, not later than 15th January, 1960. 2741

H. CLARKE & COMPANY (Manchester) LIMITED

SALES REPRESENTATIVES

required in London, Home Counties and also Scotland.

The positions are permanent and offer excellent opportunities for enthusiastic men. Knowledge of the electrical insulation industry and materials desirable although not essential.

All applications, which will be treated in strictest confidence, should give full particulars of previous experience, and should be addressed to

The Managing Director
Adas Works, Patricroft, Manchester

2679

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

APPLICATIONS are invited for the following appointments in the Board's No. 3 Sub-Area. Appointments subject to medical examination. Pension scheme.

SECOND ASSISTANT ENGINEER (Planning and Development) at Sub-Area Headquarters, Chester. Salary £1,195/£1,270 per annum (N.J.B. K/7).

Applicants should have had experience in all aspects of the distribution of electricity, knowledge of the technical and economic principles underlying the design of H.V. and M.V. distribution networks, and possess suitable technical qualifications.

FOURTH ASSISTANT ENGINEER (Planning and Development) at Sub-Area Headquarters, Chester. Salary £815/£860 per annum (N.J.B. K/13).

Applicants should have had experience on the design of H.V. and M.V. distribution networks and associated equipment, and possess suitable technical qualifications.

ASSISTANT SECTION ENGINEER in the Chester District. Salary within range £910/£955 per annum (N.J.B. H/9).

Applicants should have had experience in the construction and operation of overhead and underground distribution systems up to 33 kV, including indoor and outdoor substation equipment, and be in possession of appropriate technical qualifications.

Applications, on forms obtainable from the Manager, No. 3 Sub-Area, Electricity House, Newgate Street, Chester, must be forwarded not later than 12th January, 1960. 2767

ELECTRICAL SALES ENGINEER

BRUCE PEEBLES & Co. Limited, East Pilton, Edinburgh, 5, require an Engineer of H.N.C. standard for their Transformer Sales Department.

Five-day week; staff pension and bonus schemes. Housing assistance if necessary.

Apply, giving details of experience, to—
Divisional Director (Transformers) at the above address. 2712

LONDON ELECTRICITY BOARD

Senior Apprentice Instructor

APPLICATIONS are invited for the post of SENIOR APPRENTICE INSTRUCTOR at the Board's Training Centre, located at Camden Town, London, N.W.1.

The successful applicant will be responsible to the Training Centre Supervisor for the apprentices under instruction, for the organisation of the apprentice workshops, and for co-ordinating the work of the Apprentice Instructors. He should have been a skilled craftsman with previous experience in instructing and should be capable of teaching any of the basic engineering workshop skills with hand tools. A knowledge of machine tools, of welding and of smithing will be an additional advantage. He will also be required to supervise the work of the Training Centre labourers.

The post is graded under Schedule B of the National Joint Board Agreement as Class AX/EX, Grade 7, and the appointment will be made within the salary range £890 per annum to £1,115 per annum, inclusive of London allowance. The successful candidate will be required to work such hours as may be necessary effectively to supervise the apprentices under instruction.

Application forms obtainable from the Personnel Officer, 46, New Broad Street, London, E.C.2, to be returned completed within fourteen days of the date of publication of this notice. Please quote ref. PER/V/2829/R.

DESIGN DRAUGHTSMAN

required by progressive firm of gear manufacturers. Applicants must have the experience and a range of low-tension circuit breakers up to 36 MVA.

The vacancy of the right applicant.

Housing assistance.

Write to the Personnel Officer, 46, New Broad Street, London, E.C.2, to be returned completed within fourteen days of the date of publication of this notice. Please quote ref. PER/V/2829/R.

Situations Vacant (continued)**CENTRAL ELECTRICITY
GENERATING BOARD****East Midlands Division**

APPLICATIONS are invited for the following positions within the Division:—

**FOURTH ASSISTANT ENGINEER,
COVENTRY TRANSMISSION
SECTION**

(Vacancy No. 222/59/ER).

Applicants should have experience of the maintenance and operation of E.H.T. overhead lines, transformers and switchgear.

Preference will be given to candidates with qualifications leading to Corporate Membership of the Institution of Electrical Engineers.

Salary will be in accordance with Class AX/EX, Grade 8 (£735-£960 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 8th January, 1960.

**PLANT SHIFT CONTROL ENGINEERS,
DRAKELOW "B" POWER STATION**

(Vacancy No. 223/59/ER).

Experience desirable in control of boilers and turbines at high pressure and temperature, pulverised fuel, together with electrical control room experience.

Technical qualifications to Higher National standard desirable.

Salary will be in accordance with Class J, Grade 10 (£910-£955 per annum) of the National Joint Board Agreement, plus 10% allowance for shift duties.

Closing date for receipt of applications, 8th January, 1960.

**SHIFT CHARGE ENGINEER,
BURTON-ON-TRENT
POWER STATION**

(Vacancy No. 224/59/ER).

Sound technical training and practical experience in the control and operation of steam generating plant and main switchgear are required. Appropriate qualifications an advantage.

Salary in accordance with Class E, Grade 7 (£860-£905 per annum) of the National Joint Board Agreement, plus 10% allowance for shift duties.

Closing date for receipt of applications, 8th January, 1960.

**FOURTH ASSISTANT ENGINEER,
TRANSMISSION DEPARTMENT,
DIVISIONAL HEADQUARTERS**

(Vacancy No. 225/59/ER).

Experience in maintenance and operation of 132-kV transmission lines and substations essential.

Candidates should preferably have qualifications leading to Corporate Membership of the Institution of Electrical Engineers.

Salary in accordance with Class AX/EX, Grade 7 (£840-£1,065 per annum) of the National Joint Board Agreement, Schedule B.

Closing date for receipt of applications, 8th January, 1960.

**STATION SHIFT CONTROL
ENGINEER,
LINCOLN POWER STATION**

(Vacancy No. 232/59/ER).

Applicants should have had a sound training and practical experience in a modern power station. The possession of a Higher National Certificate in Electrical Engineering, or its equivalent, would be advantageous.

Salary will be in accordance with Class F, Grade 10 (£765-£810 per annum) of the National Joint Board Agreement, plus 10% allowance for shift duties.

Closing date for receipt of applications, 15th January, 1960.

These appointments will be pensionable within the terms and conditions of the Electricity Supply (Staff) Superannuation Scheme.

Applications should be submitted on the E6/ACT, which may be obtained from the Personnel Establishments Officer, Central Electricity Generating Board, East Midlands, Box 25, Barker Gate, Nottingham. Applications should be returned to the Personnel Officer, Central Electricity Generating Board, East Midlands, Box 25, Barker Gate, Nottingham.

For further information, contact the Personnel Officer, Central Electricity Generating Board, East Midlands, Box 25, Barker Gate, Nottingham. 2749

**COMMONWEALTH OF AUSTRALIA
SNOWY MOUNTAINS
HYDRO-ELECTRIC AUTHORITY**

vacancy for

ELECTRICAL ENGINEER

Applications are invited for the position of Engineer Grade 3, with a salary in the range £A1,545/£A1,725 per annum. Salaries for engineers in Australia are at present under review, also prospects of advancement are good. Salary will commence from date of entry on duty in Australia.

The qualifications required are a degree in electrical engineering, preferably with honours, from a recognised University together with some years' experience in a position dealing with network analysis and system planning, or familiarity with testing standards and procedures, preferably with a period in a high voltage or high power laboratory.

The successful applicant will be located, initially, at the Authority's headquarters in Cooma, New South Wales, a town with a population of about 10,000, some 70 miles south of Canberra. Housing on a rental basis will be available for a married appointee and hostel accommodation for a single man.

Subject to certain conditions the Authority will consider paying first class steamship or tourist class air fares to Australia of the successful applicant and if married, those of his wife and children under 16 years.

Applications, accompanied by a recent photograph and copies only of testimonials, giving full details of qualifications and experience and personal particulars such as age, nationality and marital status should be addressed to:—

London Representative
Snowy Mountains Hydro-Electric Authority
Africa House
Kingsway, LONDON, W.C.2

Closing date for applications is 22nd January, 1960. 2761

EASTERN ELECTRICITY BOARD**Chilterns Sub-Area
(254/59.R)****Mains Foreman, Luton District**

APPLICATIONS are invited from suitably qualified candidates for the appointment of a MAINS FOREMAN in the Luton District.

Rate of pay and conditions of service will be in accordance with the N.J.I.C. Agreement, Schedule E, Grade 1, at present £800 per annum.

Apply by letter to the Manager, Luton District, Eastern Electricity Board, 487, Dunstable Road, Luton, by 15th January, 1960. 2777

TECHNICAL AUTHORS

fully experienced in all aspects of compiling industrial and services manuals required for West London company manufacturing wide range of electronic equipment. Techniques include pulse, A.M., F.M. and transistor application.

TECHNICAL EDITOR

also required for the preparation of technical reports from notes supplied by laboratory engineers. Electronic background essential. The reports, which include illustrations, are for submission to customers and need to be of appropriate standard.

**THESE ARE ALL SENIOR POSITIONS
CARRYING COMMENSURATE
SALARIES.**

Free Life Assurance and Contributory Pensions Scheme.

Applications (in strictest confidence) to Box 2736.

**CITY OF SALISBURY,
SOUTHERN RHODESIA****Power Station Operating Staff Vacancies**

APPLICATIONS are invited for the following fixed establishment posts in the Electricity Department of the above Municipality:—

- ASSISTANT SHIFT CHARGE ENGINEERS on the salary scale £1,350 × £50 to £1,500 per annum.
- SHIFT CONTROL TECHNICIANS on the salary scale £1,150 × £50 to £1,200 × £50 to £1,300 per annum, with efficiency barrier at £1,200 per annum.

Applicants for the first position must have completed an approved course of technical education in electrical and mechanical engineering. The possession of appropriate technical qualifications will be an advantage.

Applicants for both positions must have had considerable practical experience in the operation of steam power station plant in a responsible position, and experience of control room duties on an interconnected system will be a recommendation.

The salary payable will commence at the minimum of the grade applicable to the post, rising by annual increments to the maximum salary of the grade, subject to an efficiency barrier in the case of the position of Shift Control Room Technician.

No cost-of-living, shift or other allowances are payable.

Candidates should indicate whether or not their application is limited to the senior post.

The appointments will be subject to the City Council's Service and Leave Regulations. A successful candidate will be required to furnish to the Council a satisfactory medical certificate of fitness and to serve a probationary period of not less than six months, and if thereafter confirmed in his appointment to join the Southern Rhodesia Local Authorities' Joint Pension and Widows' and Orphans' Fund. He must also be able to comply with the requirements of the Federal Immigration Authorities.

Applicants, who should be not more than 45 years of age, are required to submit full particulars of their technical education, qualifications, if any, training and experience, giving details of positions held and salaries received, marital state, age, place of birth and nationality. Copies of not more than three recent testimonials may be included.

Particulars of the undertaking and a summary of conditions of service, pension and leave entitlements, etc., may be obtained from Davis & Soper Ltd., 52 & 54, St. Mary Axe, London, E.C.3, to whom applications must be submitted on or before 15th January, 1960. 2697

ELECTRICAL ENGINEER

required for a group of mining companies in WEST AFRICA. In addition to a sound knowledge of industrial switchgear and general electrical equipment, applicant must have an intimate knowledge of modern electric winding engine control systems, including Ward Leonard, A.C. and dynamic braking.

Salary according to experience and qualifications, but would not be less than £1,500 p.a. Tours of 15 months with three months' leave on full pay. Provident fund, free accommodation and medical attention.

Applications will be treated in strict confidence. Write giving full details to

**WEST & SOUTH AFRICAN MINING
SERVICES LTD.**

120, Moorgate, London, E.C.2

2778

**CENTRAL ELECTRICITY
GENERATING BOARD****South Eastern Division**

THIRD ASSISTANT ENGINEER (Transmission Construction) required in the Croydon District. Duties will involve site supervision of all categories of 132-kV and 275-kV substations and overhead line work and major 132-kV cable installations. Qualifications leading to Corporate Membership of the I.E.E. required.

Salary within the scale £975 to £1,190, including London allowance.

Applications in writing to Personnel Officer, Central Electricity House, Lower Ham Road, Kingston-upon-Thames, Surrey, by 18th January, 1960. 2768

RAILWAY ELECTRIFICATION**ASSISTANT FOREMAN (CLASS II) REQUIRED**

Railway Male Supervisory Conditions of Service

Salary Range £637 - £672

EXPERIENCE in erection, repair and maintenance of overhead line contact systems. Should possess sound knowledge of safety precautions, electrical, mechanical and personnel.

The successful applicant will be temporarily located at Romford, Essex, but will be required to work in any section of the Eastern Region electrification.

Apply to:—

Electric Traction Engineer

British Railways, Eastern Region, Ley Street, Ilford, Essex

2781

CENTRAL ELECTRICITY GENERATING BOARD

South Western Division

THIRD ASSISTANT ENGINEER required in the System Operation Department at Divisional Headquarters, near Bristol.

Superannuation scheme. Salary N.J.B. Class AX/EX, Grade 5, £1,090-£1,215/£1,355 per annum.

Duties include long-term forecasting of plant and load, units generated, etc., and generally assisting with the day-to-day arrangements associated with the Grid control room.

Applicants should have had a good general and technical education, preferably leading to I.E.E. membership, and should be interested in organisation. Power station experience will be an advantage.

Closing date 9th January, 1960. Quote Vacancy SW/AV/107/59.

CHIEF DRAUGHTSMAN required in the Electrical Department at Divisional Headquarters, Bristol.

Superannuation scheme. Salary, N.J.B. Schedule D, Grade 2, £1,180-£1,305 per annum.

The successful candidate will be required to take charge of a drawing office providing engineering, cartographical and general services. Responsible experience in leading a team of draughtsmen engaged on the layout of electrical plant and equipment is essential. Experience of high-voltage transmission systems will be an advantage. Technical education to H.N.C. desirable.

Closing date 14th January, 1960. Quote Vacancy SW/AV/108/59.

Applications on form A.E.6/ACT, obtainable from the Divisional Secretary, 26, Oakfield Rd., Bristol, 8, should be completed and returned by the date stated.

2754

AIR MINISTRY

ASSISTANT MECHANICAL AND ELECTRICAL ENGINEERS required for design, construction and maintenance of installations on airfields, radar stations, missile bases, workshops and maintenance units for R.A.F. at home and overseas as well as certain Civil Airports.

Salary £805 at 25 to £1,095 at 34 or over, thereafter rising to maximum £1,260 with increase for London and slight decrease for country districts. Appointments non-pensionable but long term. Promotion prospects. 5-day week with 4 weeks 2 days leave a year initially. Special allowance in addition to salary during overseas service.

Qualifications and experience: (i) (a) Degree or equivalent diploma in electrical and/or mechanical engineering with at least 2 years' apprenticeship, or (b) Graduate or Corporate Member of I.E.E. with at least 3 years' apprenticeship, or (c) Graduate or Corporate Member of I.Mech.E., appreciable electrical engineering experience with at least 3 years' apprenticeship, and (ii) have been employed for minimum of two years with well-established engineering concern and gained wide experience in both electrical and mechanical engineering practice. Applicants must be natural-born British subjects aged 25 to 45.

Forms from Ministry of Labour, Technical and Scientific Register (K), 26, King Street, London, S.W.1, quoting D.555/9A.

260

LONDON ELECTRICITY BOARD

Vacancy: Engineering Draughtsman

APPLICATIONS are invited for the above position in the Board's West End District at Eccleston Place, London, S.W.1.

Candidates should have a good general and technical education and possess the Ordinary National Certificate (Building). The successful applicant will be required to prepare working drawings in connection with the conversion of existing premises into transformer chambers, and a knowledge of simple reinforced concrete structures would be advantageous. Experience in electrical plant layout will also be an advantage.

The post is graded under Schedule D of the National Joint Board Agreement as Grade 6, £660 to £780 per annum, inclusive of London allowance.

Application form, obtainable from the Personnel Officer, 46, New Broad Street, London, E.C.2, to be returned completed within fourteen days of the publication date of this notice. Please quote ref. PER/V/2831/R.

2740

LIGHTING SALES ENGINEER

APPLICATIONS are invited for the position of **LIGHTING SALES ENGINEER**, under 35 years of age, preferably Dip.M.I.E.S., but not essential, to cover electrical contractors, wholesalers, electricity boards, architects, etc., in Leicestershire, Lincolnshire, Nottinghamshire and Northants. Should be resident in area, with required sales and technical experience.

Attractive salary, car provided and reimbursement for expenses.

Write in confidence, giving full details of age, education, sales experience, etc., and salary expected, to the—

Area Manager

THE BENJAMIN ELECTRIC LTD.

5, Corporation Street, Birmingham, 2

2757

NORTH OF SCOTLAND HYDRO-ELECTRIC BOARD

Dundee Area

Mains Records Draughtsman

APPLICATIONS are invited for the post of **MAINS RECORDS DRAUGHTSMAN**. Applicants must be capable of producing neat and accurate work. The ability to drive will be an advantage.

Salary according to N.J.C. Agreement (Draughtsman Scale), £205/£590, with placing according to education, experience, etc. There are prospects of advancement for suitably qualified applicants. Superannuation scheme.

Applications should be made on the standard application form obtainable from the Area Manager, 7, Dudhope Crescent Road, Dundee, and should be completed and returned not later than Friday, 8th January, 1960.

2755

CENTRAL ELECTRICITY GENERATING BOARD

North Eastern and Yorkshire Region

Third Assistant Engineer

APPLICATIONS are invited for appointment as **THIRD ASSISTANT ENGINEER** in the Protection Section of the Technical Department, Yorkshire Division, based on Leeds.

Applicants should possess technical qualifications leading to Corporate Membership of the I.E.E. and be experienced in the testing and maintenance of protective and control equipments applicable to high-voltage generation and transmission systems. Works experience will be an advantage.

The salary for the appointment will be in accordance with Grade 6, Schedule B of the National Joint Board Agreement (£925-£1,170 per annum) and will commence at a point commensurate with qualifications and experience.

Forms of application may be obtained from Assistant Regional Secretary (Personnel), Central Electricity Generating Board, North Eastern and Yorkshire Region, 1, Whitehall Road, Leeds, 1, to whom they should be returned to arrive not later than 8th January, 1960.

2750

LONDON ELECTRICITY BOARD

Engineering Draughtsmen

ENGINEERING DRAUGHTSMEN are required for positions in the Engineering Drawing Office of the Chief Engineer's Department at Waterloo, London, S.E.1.

(a) Draughtsmen experienced in the layout of E.H.V. transforming plant.

(b) Draughtsmen experienced in surveying on site the laying of E.H.V. cables.

Applicants should possess the Ordinary National Certificate, have preferably served an engineering apprenticeship, and had experience in one or other of the above.

The posts are graded under Schedule D of the N.J.B. Agreement as Grade 6, £660 to £780 per annum, inclusive of London allowance. Commencing salary will be dependent on qualifications and experience.

Application forms obtainable from the Personnel Officer, 46, New Broad Street, London, E.C.2, to be returned completed within fourteen days of the publication date of this notice. Please quote ref. PER/V/2830/R.

2731

ADMIRALTY

TECHNICAL CLASS GRADE III OFFICERS required for Naval Aircraft Repair Organisation. Vacancies exist primarily in the London, Portsmouth, Belfast and Chippenhams areas. Candidates must be British subjects, aged 21 or over. Qualifications: a recognised apprenticeship, O.N.C. or equivalent in electrical engineering and a good knowledge of electronics as applied to airborne radar and radio equipment and instruments. Service in the Air Electrical Branch of R.N. or R.A.F. would be valuable.

Five-day week, eighteen days' annual leave. Salary in the range £565 (age 21) to £750 on entry, rising to £875 (National rate). The posts are non-pensionable.

Applications, with full personal details, to Ministry of Labour, Professional and Executive Register, 20, Nelson Street, Bristol, 1, quoting PE.5343.

2764

LONDON ELECTRICITY BOARD

Engineering Draughtsman

APPLICATIONS are invited for the above position in the Board's Contracting Section at Stratford Place, London, W.1.

Candidates should have a good general and technical education and be in possession of the Ordinary National Certificate. They should be able to prepare working drawings from sketches and schematic layouts, and prepare the associated cable schedules.

The post is graded within Schedule D of the National Joint Board Agreement as Grade 6, £660 to £780 per annum, inclusive of London allowance.

Application forms obtainable from the Personnel Officer, 46, New Broad Street, London, E.C.2, to be returned completed within fourteen days of the publication date of this notice. Please quote ref. PER/V/2811/R.

2730

Situations Vacant (continued)

CENTRAL ELECTRICITY
GENERATING BOARD

Midlands Division

THIRD ASSISTANT ENGINEER is required in the Protective Gear Section of the Technical Department. N.J.B. service conditions, superannuable appointment, salary within Schedule B, Grade 6, commencing in range £925-£1,050, ultimately rising to £1,170 per annum.

Applicants should hold a university degree, Higher National Certificate or equivalent qualifications in electrical engineering, and should have sound knowledge of protective gear, including the commissioning of electrical plant in power stations and high-voltage substations. Experience with a switchgear manufacturer would be an advantage.

Apply, quoting Vacancy No. 206/59MD, on Form AE6, available from the Establishments Officer, 53, Wake Green Road, Moseley, Birmingham, 13, by 18th January, 1960.

2785

J. & P. CAPACITOR DEPARTMENT

JOHNSON & PHILLIPS Ltd. have a vacancy in their Capacitor Department, Test Section, for a young man holding H.N.C. Good opportunity for a progressive man to work in a modern well-equipped factory.

Excellent canteen facilities, pension scheme, etc.

Applications giving full particulars of training and experience, together with age, to:—

Employment Manager
JOHNSON & PHILLIPS LTD.
Charlton, London, S.E.7

2739

RADIO RESEARCH STATION,
DITTON PARK, DATCHET, SLOUGH

D.S.I.R. requires **ASSISTANT EXPERIMENTAL OFFICER/EXPERIMENTAL OFFICER** at RADIO RESEARCH STATION, Ditton Park, Datchet, Slough, Bucks., to prepare abstracts of scientific and technical articles on radio research and development.

Qualifications: G.E.C. "A" level in two science or mathematics subjects or equivalent, preferably in physics or electrical engineering. Over 22, pass degree, H.N.C. or equivalent generally expected. Experience in radio research or development, or communications, and ability to read technical French and German an advantage.

Salary ranges: A.E.O. £382 10s.-£830; E.O. £954-£1,166.

Forms from Ministry of Labour, Technical and Scientific Register (K), 26, King Street, London, S.W.1 (quote A.340/9A).

2733

CENTRAL ELECTRICITY
GENERATING BOARD

Midlands Division

ASSISTANT ENGINEER (Operation and Efficiency) is required for Ironbridge Power Station, Buildwas, Salop. N.J.B. service conditions, superannuable appointment, salary within Schedule A, Grade J.8, £1,025-£1,085 per annum.

Applicants should have received a sound technical and practical training, and should have considerable experience in the operation and maintenance problems arising in a large power station. The possession of a recognised technical qualification will be an advantage.

Apply, quoting Vacancy No. 207/59, on Form AE6, available from the Establishments Officer, 53, Wake Green Road, Moseley, Birmingham, 13, by 18th January, 1960.

2784

MECHANICAL ENGINEER

with senior status required for research and development work in Manchester. Honours degree, good knowledge of thermodynamics, metallurgy experience with design calculations of various kinds of thermal plant essential.

Apply Kennedy & Donkin, 12, Caxton Street, London, S.W.1, or 64, Royal Exchange, Manchester.

2700

SOUTHERN RHODESIA ELECTRICITY
SUPPLY COMMISSION

VACANCIES: ASSISTANT DISTRICT ENGINEERS, GRADE II. Salary scale £1,440 per annum by increments to £1,620 per annum.

Married accommodation is available at a rental of 12½% of salary.

Applicants must be in possession of an Engineering Degree and/or Graduate Membership of the Institution of Electrical Engineers and should have experience in the operation of E.H.V. systems including substation and protective equipment.

Rail and steamship fares to Southern Rhodesia will be paid for the successful applicants, wives and children under 18 years of age. Half salary is payable from the date of embarkation, until assumption of duties. Leave conditions are generous and contributory medical aid and holiday fund schemes are in force.

Application forms and further information from Secretary (ESC), Rhodesia House, 429, Strand, London, W.C.2. Closing date 31st January, 1960.

2735

CONTACTOR ENGINEER/DESIGNER

required by progressive company.

The position offers prospects for advancement and is pensionable.

Housing available.

Write giving details of age, experience, etc., to—Box 2743.

ELECTRICAL ENGINEER

APPLICATIONS are invited from suitably qualified engineers who wish to specialise in automatic control gear design and transistor circuitry for a post with a young company in the North-East. Some works and drawing office experience desirable. Excellent opportunity for an enthusiastic and ambitious man.

Write stating age, qualifications and salary to—Box 2756.

AN electro-mechanical draughtsman required by engineering company. Must be capable of detailed design and systematic handling of various projects. 5-day week, canteen, pension fund. Apply in writing stating age, previous experience, qualifications, if any, to Personnel Officer, Dewhurst & Partner Ltd., Inverness Road, Hounslow, Middlesex.

APPLICATIONS are invited from ambitious and resourceful men to fill the position of technical assistant to the sales manager of electric lamp machinery manufacturers near London. A permanent, progressive and interesting job is offered to the right person, who must possess a sound engineering and commercial background in the trade. Applications with full particulars of education, experience and salary required to—Box 328.

CHARGEHANDS and electricians required for large screwed conduit contracts. Applicants must be fully skilled and had considerable experience.—Electra, 256, Terminus Road, Eastbourne.

CIRCUIT draughtsman. Young man, age 22/35, required for circuitry work associated with automatic control gear. O.N.C. standard preferred. Permanent and progressive position. Pension fund, canteen. Apply in writing giving full details of age, experience and qualifications, if any, to Personnel Officer, Dewhurst & Partner Ltd., Inverness Road, Hounslow, Middlesex.

CIRCUIT engineer required for development work. Previous experience of control gear desirable. Minimum academic qualifications, H.N.C. Permanent and pensionable position. Please write giving full details of age, experience, etc., to Personnel Officer, Dewhurst & Partner Ltd., Inverness Road, Hounslow, Middlesex.

CONTROL gear engineer required. Age 23/35. For layout and circuiting of contactor equipment. Experience of lift equipment would be an advantage. Permanent and progressive position. Good salary. Canteen, pension fund. Write stating age, experience and qualifications, if any, to Personnel Officer, Dewhurst & Partner Ltd., Inverness Road, Hounslow, Middlesex.

322

CONSULTING engineers have vacancies for experienced electrical draughtsmen for lighting and power installations in all classes of buildings, including nuclear energy field. Good salary and pension scheme. Write in first instance to E. G. Irwin & Partners Ltd., 2, Princes Row, Buckingham Palace Road, London, S.W.1.

DRAUGHTSMAN, preferably with O.N.C. and experience of transformers. This position is with an expanding company and offers scope for advancement. Apply Chief Engineer, Twickenham Transformers Ltd., Richmond Road, Twickenham (PO) PEs Grove 9141).

DRAUGHTSMEN, electrical and mechanical, required by engineering consultants. Knowledge of power station work an advantage. Positions permanent, pensionable, five-day week, free lunches. Write Personnel Department, Ewbank & Partners Limited, 10-11, Grosvenor Place, London, S.W.1.

ELECTRICAL engineer required by British Petroleum Company Limited for service in the Persian Gulf on off-shore drilling project. Applicants, aged 28-35, must hold an H.N.C. at least, and should have experience in the installation, operation and maintenance of small power systems and associated switchgear and transformers with overhead and underground transmission up to a maximum of 3.3 kV. Experience with diesel alternator maintenance an advantage. As no married accommodation, bachelors preferred, though fortnight's leave every four months permits free travel to the U.K. periodically. Attractive salary plus generous allowances, free passage out and home. Free medical attention. Kit allowance. Write giving full particulars, quoting F.583, to Box 3221, c/o 191, Gresham House, London, E.C.2.

ELECTRICAL engineer required by London consulting engineers for preparation of design, specifications, etc., for schools, hospitals and commercial buildings, etc. Write stating age, experience, qualifications and salary required to—Box 160.

ELECTRICAL engineer required for London consulting engineers' office. Applicants should be Associate Members of the I.E.E. and experienced in the complete design of electrical services in hospitals, universities, colleges, etc.—Box 2773.

ELECTRICAL engineering assistants reqd. with expce. of (a) preparation of specifications for electrical installations in buildings; (b) maintenance and improvement of electrical installations; (c) installation and/or maintenance of electric lifts. Up to £895 in entry grade, with promotion prospects for those obtaining H.N.C. (elec.). Pension scheme. Staff restaurant on premises. One Sat. only worked in five. Appln. form from Chief Engineer (60/3), L.C.C., County Hall, London, S.E.1. (2824)

ENGINEERING trade association at Ascot, Berks, requires an assistant with practical training in electrical engineering. Applicants should have experience in estimating for power transformers. Age 25/35. Salary paid will be commensurate with age, experience and qualifications. Pension scheme. Full applications to—Box 2701.

EXCELLENT prospects for contract engineers and supervisors experienced in electrical cable work, overhead line transmission and installations, Midlands and Southern England. The aim of the company is expansion with obvious promotion opportunities. Apply giving full particulars. Early interviews arranged.—Box 325.

FIRM of 40 years' standing requires representative already calling on electrical trades, electricians, electrical factors, etc. Good repeatable lines. Very attractive commission. Districts: S. Wales, N.W. England, Midlands, S.W. England, Scotland, London and Southern Counties.—Box 2774.

REQUIRED for large coal mining organisation in Chile, South America: Assistant chief electrical engineer. Applicants must have wide experience of planning and maintenance of mining equipment and of the application of planned maintenance schemes. Duties will also include taking charge of all underground mechanical and electrical installations. Applicants should preferably possess qualification of A.M.I.E.E. Knowledge of Spanish an advantage. Prospects for future advancement extremely favourable. Apply in writing for application forms to the Chief Engineer, Powell Duffryn Technical Services Ltd., 19, Berkeley Street, London, W.1.

2783

INSPECTOR for electrical work required with experience of lifts. Up to 292s. 6d. Pensionable. Application form from Chief Engineer (60/4), L.C.C., County Hall, London, S.E.1. (2845) 2772

SOUTH WALES SWITCHGEAR Ltd., Treforest Industrial Estate, Glamorgan, require an experienced draughtsman for development of transformers up to 15 MVA. H.N.C. preferable. Good opportunity for man with personal initiative. Application giving full particulars of age, experience and qualifications to the Personnel Manager. 2684

TEST engineer required for test department of leading control gear manufacturers, having experience of control gear for machine tools, heating and ventilating and pumping applications, etc. First-class working conditions, modern premises, bonus scheme after qualifying period. Apply M.T.E. Control Gear Ltd., Progress Road, Eastwood, Leigh-on-Sea, Essex. 2759

TRANSFORMER representative for the electronic and industrial transformer fields. Preference will be given to a person already engaged in a similar capacity. Salary plus commission. Car will be supplied.—Willesden Transformer Co. Ltd., Manor Park Road, Harlesden, London, N.W.10. 309

TREFOREST ELECTRICAL SERVICES Ltd., Aberbargoed, Mon., have vacancies for draughtsmen, preferably with experience in design or low-tension switchfuse or motor-controlled gear. Consideration will be given to applicants with good mechanical experience and are prepared to be trained in the electrical field. Housing available to suitable applicant. Applications giving particulars of age, experience, etc., to the Personnel Manager. 2744

APPOINTMENTS FILLED

Dissatisfaction having so often been expressed that unsuccessful applicants are left in ignorance of the fact that the position applied for has been filled, may we suggest that Advertisers notify us to that effect when they have arrived at a decision? We will then insert a notice free of charge under this heading.

SITUATIONS WANTED

SALES manager, A.M.I.E.E., public school (42), works trained, seeks change. Top contacts industry and boards in South, handling switch and control gear, also motors, electronics, installation work. About £1,750.—Box 9882.

ARTICLES FOR SALE

EASTERN ELECTRICITY BOARD

Norfolk Sub-Area

Tenders for the Purchase D.C. Converting Plant, Norwich

TENDERS are invited for the following equipment:—

2 SIEMEN'S 600-r.p.m. Rotary Converters, 1,200 kW, with D.C. starters, circuit breakers and shunt regulators.

1 1,270-kVA SIEMEN'S Transformer.

1 B.T.H. Rotary Converter, 1,500 kW, with BRUSH starting panel, field regulator and D.C. circuit breaker.

1 1,650-kVA BRUSH Transformer.

This equipment can be inspected upon application to the District Manager, Eastern Electricity Board, 4, Duke Street, Norwich (Telephone, Norwich 24242).

The purchaser will be responsible for the removal of the machines and making good any damage.

Tenders can be made for one or more of the machines and should be sent to the Secretarial Officer, Eastern Electricity Board, Norfolk Sub-Area, 4, Duke Street, Norwich, Nor. 23A, to reach him by Monday, 1st February, 1960.

Envelopes should be marked "Tender for D.C. Converting Plant, Norwich."

The Board does not bind itself to accept the highest or any tender. 2752

HOUSE SERVICE METERS

200—240-v. A.C. or D.C., 10 amps. capacity, quarterly type, from 25s. each, plus 2s. 6d. carr.

UNIVERSAL ELECTRICAL CO.

221, City Road, London, E.C.1 37

600

VARIABLE SPEED DRIVES, 415/3/50 INPUT

H.P.	Speed.	Maker.	Remarks.
0/525	0/1000	G.E.C.	Ward Leonard
0/340/340	0/1200/1600	E.E.C.	" "
0/275/275	0/1500/1800	E.E.C.	" "
67.5/270	95/370	B.T.H.	Schrage Motor
0/200/200	0/750/960	G.E.C.	Ward Leonard
0/150/150	0/1000/1700	BRUSH	" "
0/130	0/1000	L.S.E.	" "
35/70	650/1300	B.T.H.	Remote C. Schrage
0/60	0/1500	ALLEN	Ward Leonard
0/50/50	0/2000/2900	E.E.C.	" "
0/45	0/2700	L.S.E.	" "
20/40	500/1000	B.T.H.	Schrage
0/33/33	0/1200/1500	MAWDSLEY	Ward Leonard
0/20/26	0/2000/2500	E.E.C.	" "
4.5/21	0/1450	FULLER	Schrage

Prompt despatch all covered by guarantee.

GEORGE COHEN

Sons & Co. Ltd.

Wood Lane, London, W.12

(Shepherds Bush 2070)

Stanningley, Nr. Leeds

(Pudsey 2241)

2751

600

OIL-COOLED TRANSFORMERS

kVA	Primary	Secondary	Maker	Remarks
600	6600	400/3/50	B.E.T.	Delta/Star
440	6350	400/3/50	G.E.C.	" "
400	3300	440/3/50	G.E.C.	" "
300	6500	465/3/50	HACKBRIDGE	" "
300	3300	450/3/50	B.T.H.	" "
200	400	200	YORKSHIRE ELECT.	Star/Auto
200	11000	433	THERMO CONTROL	Delta/Star
150	10750	440/3/50	FOSTER	" "
150	6600	420/3/50	YORKSHIRE	" "
100	11000	415/3/50	S. WALES SWITCHGEAR	" "
50	3300	400/3/50	HACKBRIDGE	" "
32	400	200/400/3/50	BRENTFORD	Several available
30	3300	400/3/50	HACKBRIDGE	Variable voltage
10	3300	400/3/50	MET.-VICK.	Delta/Star
10	400/1/50	20/40	B.E.T.	" "
6	400/1/50	10/20	B.E.T.	Air cooled variable voltage

Selection only from our comprehensive stock.
All covered by our guarantee.

GEORGE COHEN

Sons & Co. Ltd.

Wood Lane, London, W.12

(Shepherds Bush 2070)

Stanningley, Nr. Leeds

(Pudsey 2241)

2779

DIESEL GENERATOR SET FOR DISPOSAL

ONE MIRRLEES HF7 Diesel Generator, continuous rating 475 kW at 375 r.p.m. Complete with all A.C. driven ancillaries, including HEENAN & FROUDE water cooler and fuel header tank.

One BRUSH 475-kW, 250-volt, compound wound D.C. Generator direct coupled to the above engine. Fitted with local and remote control equipment and switchgear (panel mounted). In conjunction with the above diesel, one waste heat boiler (CLARKSON), rated at 850 lb./hr., 40 p.s.i. working pressure, complete with feed pump and auxiliary equipment.

Two Waste Heat Boilers (CLARKSON) rated at 850 lb./hr. at 40 p.s.i. W.P., together with WEIR feed pumps and thermofeed, etc. Suitable for use as waste heat equipment on diesel engine exhausts.

Applications to—Box 2771.

A.A. ELECTRICAL CO. for A.C.-D.C. motors, switchgear, exhaust fans, hoists, reduction gears, new or reconditioned units.—CHI. 5105. 67, Rothschild Rd., London W4. 57

ELECTRIC HOUSE SERVICE METERS

PREPAYMENT and credit, 200/250 v. A.C., 5 p.p., 50 c., 2½-100 A. Fixed or variable tariff. Reconditioned, fully tested and guaranteed 2 years. Prompt delivery, carriage paid.

ALBERICE METER COMPANY

87/89, Sterte Avenue, Poole, Dorset

(Tel.: Poole 272)

371, West Green Road, Tottenham, London, N.15 (Tel.: Bowes Park 7080) 191

CHAIN MAKERS, WIRE FORMERS AND PRESS WORKERS

CHAINS of every type and finish for suspending fittings, etc.; Hooks, Rings and Wire forming.

A. J. PRATT & SONS LTD.

Chain House, Woodbridge St., London E.C.1
(Tel. CLERkenwell 3742/3) 2738

ALTERNATORS, 3-phase, all sizes in stock from 7 kVA up to 330 kVA.—Britannia Manufacturing Co. Ltd., 20/26, Britannia Walk, London, N.1 (CLERkenwell 5512). 24

Articles for Sale (continued)

600**STANDARD A.C. MOTORS, 415/3/50, PROTECTED FRAME, BALL/ROLLER BEARINGS**

H.P.	Speed	Make	Remarks
125	2900	CLARKE CHAPMAN	Squirrel Cage
120	720	BROOK	Slipring
100	485	BROOK	Slipring
90	725	MET.-VICK.	Slipring
60	970	E.E.C.	Slipring
50	725	E.E.C.	Slipring
40	960	HOLMES	Slipring
40	1440	C.P.	Squirrel Cage
35	1460	BROOK	Slipring
35	960	BROOK	Slipring

Starting Gear available.
Prompt Delivery, covered by Guarantee.

GEORGE COHEN

Sons & Co. Ltd.
Wood Lane, London, W.12
(Shepherds Bush 2070)
Stanningley, Nr. Leeds
(Pudsey 2241)

2780

A BABCOCK & Wilcox water tube boiler will cut down your fuel costs; we can supply from stock. Two 40,000 lb. evap., 220 lb. w.p.; one 25,000 lb. evap., 200 lb. w.p.; 3,000 lb. evap., 400 lb. w.p.; Spencer Bonecourt boiler; also Marine, Cornish vertical, etc.—Burford, Taylor & Co. Ltd., Boiler Specialists, Burtayco House, Church Street, Middlesbrough (Tel. Middlesbrough 2622). 122

A C. and D.C. motors, generators, from stock.—Service Electric Co. Ltd., Honeyport Lane, Stanmore, Middx. (Edgware 5566/9). 91

A C. and D.C. 1/- slotmeters. Guaranteed 2 years, 2½–50 amps. From 55/-. Repairs and recalibrations. See Billiard: Tradex Meter Co., Surbiton (Tel. Elmbridge 4487). 169

A LTERNATORS and generators, all types up to 150 kW.—Powerco Ltd., 312, York Road, London, S.W.18 (VAN. 5234). 151

A UTO-synchronous motors, 2 available, 50 h.p., 1,000 r.p.m., by Crompton Parkinson, 400 v., 3-phase, 50 cycles, with starters. Further details from—Dynamo & Motor Repairs Ltd., North End Road, Wembley Park. 79

B ARGAINS in electric motors from A. Cooksley & Co. Ltd., 21/25, Tabernacle Street, London, E.C.2. Ring Monarch 3355. 50

B ILLIARD Meters. 1/-, 6d. or rd. slot. All time settings. From 170/-. See Quarterly.—Tradex, Surbiton. 170

C ABLE, underground, all types ex stock.—E. M. Tatton Co. Ltd., Kew Bridge, Brentford (ISLeworth 4534/5). 117

C ABLE, underground, PILC/VIR/LC, ex London stock. Cutting orders same day delivery London area. Send for priced stock lists.—Batt Electrical Co., 6, Dock Street, London, E.1 (Tel. ROYAL 5905). 316

C IRCUIT breakers, various sizes in stock, A.C. and D.C., 200 amperes up to 2,000 amperes. Also dynamo and alternator switchboards.—Britannia Manufacturing Co. Ltd., 22/26, Britannia Walk, London, N.1. 26

C ONVERTERS, motor-alternators, motor-generators, frequency changers, etc. All types up to 100 kW.—Powerco Ltd., 312, York Rd., London, S.W.18 (VAN. 5234). 150

C RANE motors. Direct current, series wound or compound wound, all voltages. We hold large stocks.—Britannia Manufacturing Co. Ltd., 22/26, Britannia Walk, London, N.1. 22

D IESEL generating sets, all sizes to 500 kW. Britannia Mfg. Co. Ltd., Britannia Walk, London, N.1. 16

E LECTRIC motors, dynamos, alternators and motor generator sets of all sizes. We hold one of the largest stocks in England. New and reconditioned, with 12 months' guarantee.—Britannia Manufacturing Co. Ltd., Britannia Walk, London, N.1 (Clerkenwell 5512, 3 lines); also Works and Stores, Chobham, Surrey. 20

E LECTRIC motors, generators, motor generator sets, transformers, switchgear, etc., large comprehensive stock, overhauled and guaranteed. Copy of our Register, "Electrical Surplus," containing thousands of items of electrical plant, sent on request.—R. F. Winder Ltd., Belgrave Electrical Works, Leeds, 2. 54

E LECTRIC motors, generators, control gear, transformers, A.C. and D.C., new and reconditioned; all covered with our usual 12 months' guarantee; large stocks available.—Electropower Co. Ltd., Kingsbury Works, Kingsbury Road, London, N.W.9 (Colindale 4621-2). 42

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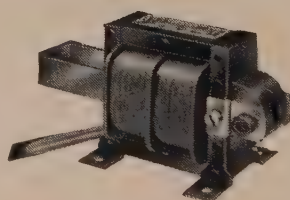
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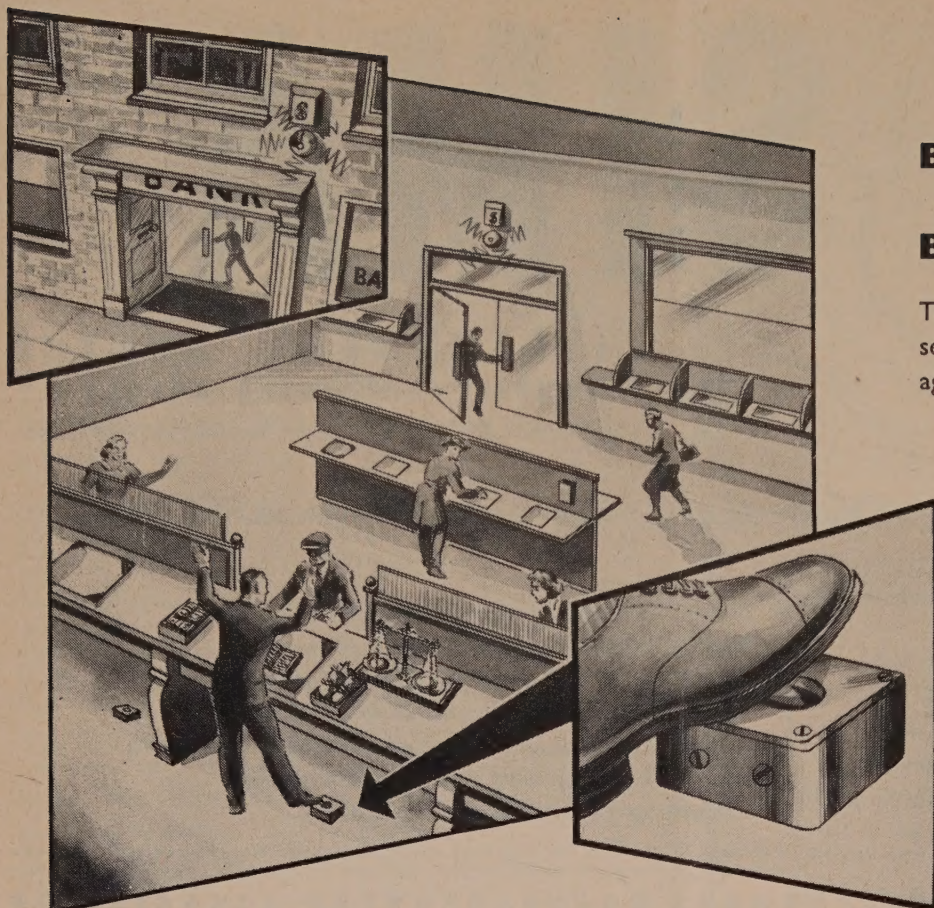


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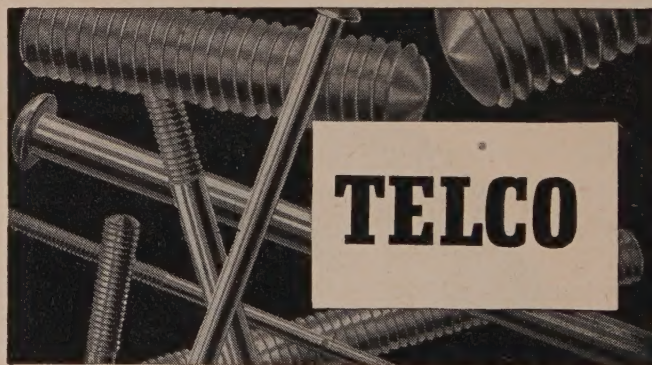
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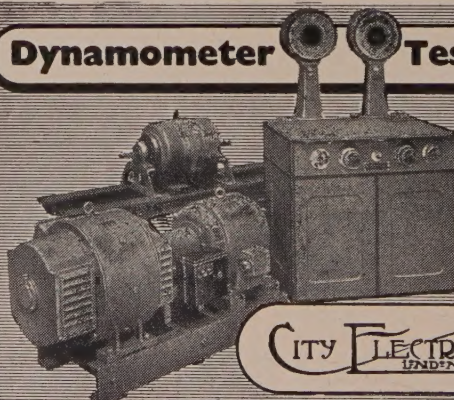
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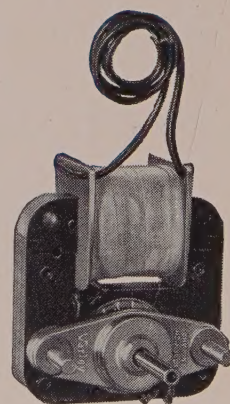
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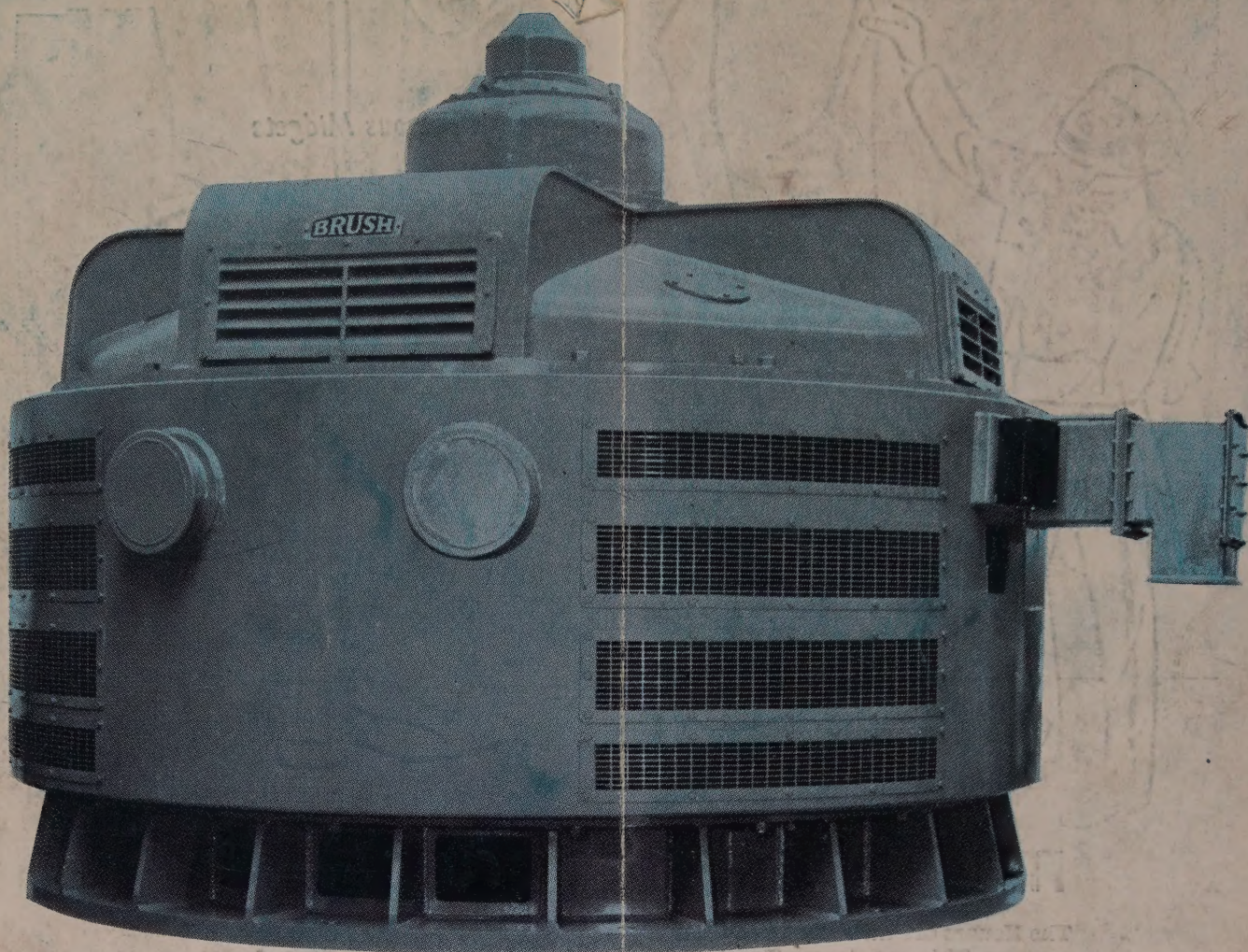
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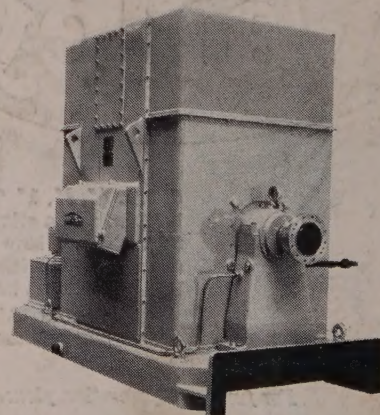




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